ECONOMICS OF OIL: A CASE STUDY OF LIBYA

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by

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ABSTRACT

In the last few decades the economics of oil has been very much influenced by the Organization of Petroleum Exporting Countries (OPEC). OPEC behaviour has been a paradox to economists and politicians alike; this thesis attempts to analyse how OPEC members actually behave, and to assess the impact such behaviour has on their economic development.

The common view about OPEC since 1973 is that it is a real cartel, controlling world oil prices. This view has become even more popular since production quotas were introduced in 1982. This thesis offers an alternative explanation of OPEC behaviour, derived from a game theoretic approach. It is suggested that OPEC success during the 1970s had been a result of a game between Libya and the international oil companies at the beginning, and a game between OPEC as a whole and the international oil companies later on. Furthermore, the present and future oil market situation depends upon the likely outcome of the game between OPEC members themselves on the one hand, and the game between cooperative producers and non-cooperative producers on the other.

This thesis has been organised into two parts. The first part consists of four chapters which offer a general analysis of OPEC behaviour. Chapter 1 provides a background to the pre-OPEC oil market and the environment and the factors which led to the creation of OPEC. Chapter 2 outlines the theory of exhaustible resources, which is the main theoretical source for OPEC behaviour models. The division of oil revenues between present and future generations is also considered. Chapter 3 provides a critical review of OPEC behaviour models; game theory is introduced as an alternative to the existing models. Chapter 4 provides an account of how OPEC became the dominant power in the world oil market.

The second part consists of three chapters which analyse the Libyan economy. Chapter 5 discusses the pre-oil Libyan economy and the emergence of the petroleum sector. Chapter 6 assesses the post-oil Libyan economy. Chapter 7 considers the efforts of the Libyan Government in the development of its oil industry and the role of Libya in the confrontation with international oil companies.

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CONTENTS

PART II

INDEX OF TABLES

INDEX OF FIGURES

INDEX OF DIAGRAMS AND MAPS

Part I

CHAPTER 1: INTRODUCTION

The nature of the oil industry as a capital intensive industry and the high level of technology involved in it, led to the limitation on the number of companies which actually control the industry. The famous Seven Sisters until recently monopolized the exploration, production, marketing and refining of crude oil in the free world. Unfortunately the term "monopoly" which has been used to describe the behaviour of oil companies, is now used to describe the behaviour of Organization of Petroleum Exporting Countries (OPEC), even 25 years after its creation. Although this seemed to be the case in the early 1970s, the above term does not describe its long-run behaviour.

The failure of cartelisation theory to offer a practical explanation of OPEC behaviour made the search for alternative interpretations to OPEC's paradoxical behaviour a topic for further research. This study attempts to make use of the general concept of game theory as a way of assessing the individual country's interests, which range from cooperative to non-cooperative behaviour. OPEC stability, according to this study, will depend upon the over-all effect of the individual countries's behaviour.

The oil game since 1970 has had the following stages:

Libya	V	International oil companies
OPEC	V	International oil companies
Nigeria, Iran or Libya	V	Saudi Arabia
World cooperative producers	V	World non-cooperative producers

The main proposition of game theory is that two or more individual players influence a situation (outcome of the game) and the interests of the players (their utilities from the various possible outcomes) differ.

Differences between the various interests of the players gives rise to conflict, just as the identity of all utilities makes the game a pure coordination problem where cooperation is the only rational behaviour.

In nonzero-sum games, elements of conflict provide the dramatic interest, mutual dependence is part of the logical structure and demands some kind of collaboration or mutual accommodation, tacit if not explicit, even if only in the avoidance of mutual disaster. The mutual interdependence of OPEC producers suggests a possible application of game theory to an analysis of OPEC behaviour.

Nonzero-sum games are divided into two classes: cooperative, where collusion occur, and non-cooperative, where collusion does not occur. In a cooperative case the players are taken to cooperate on any and every action which can increase the payoff of either player (provided it does not, at the same time, reduce the payoff of the other). The objective of OPEC producers is to maximize their revenues, either by increasing crude prices or volume of output. Studies have shown that OPEC countries in the 1960s increased their output in order to maximize their revenues. By the mid-1970s, where cooperation between members was apparent, OPEC producers increased their payoffs by raising crude prices, while in the 1980s it seems neither output nor prices is to be increased, mainly for reasons of non-cooperation. The problem is that the violation of an output agreement or quota by any OPEC member necessitates a direct cut of some other member's quota. This sort of action is really a step towards non-cooperation, because it threatens the ability of the other members to maximize their revenues. Non-cooperative behaviour is the natural alternative to cooperative behaviour. Having reached an agreement on prices and output quotas each OPEC member prefers to stick to the agreement. That is, each member prefers others to pursue the group

interest rather their own parochial interests. On the other hand, the member in question prefers to pursue his own self-interest and thus may prefer to violate the price and production quota agreement. Some members, such as Nigeria and Iran, have recently acted according to their individual interests regardless of OPEC agreements. For example, Nigeria reduced the price of its crude following the British National Oil Corporation (BNOC) price reductions in March 1983 and October 1984, regardless of the OPEC official price. At the same time, Nigeria was reported to have overproduced at 1.5 mb/d in 1983, while its quota was only 1.3 mb/d.

Even though in recent years OPEC has not acted as a unified cartel, because of the violations in price-output agreements by some members, others have accommodated these violations in order to prevent unstable situations. For example, when the demand for OPEC oil fell from about 23 mb/d in 1981 to 19 mb/d in 1982 some OPEC members, such as Saudi Arabia, Kuwait, and the UAE, reduced their production to prevent a fall in price. Another example was in October 1984, when the North Sea oil price was reduced and Nigeria followed; immediately Saudi Arabia announced that it would cut its production in an attempt to limit further price reductions. Thus while Nigeria violated the price-output agreement, Saudi Arabia tried to protect the collective agreement. Shortly after that, on 29 October, OPEC ministers agreed to reduce their production by 1.5 mb/d to 16 mb/d. The result is that cooperation and non-cooperation do exist. And OPEC will be stable as long as the group preference is maintained by the individual members, or at least by a sufficient number of producers.

While OPEC success or failure depends on the individual members' behaviour, these members depend to a great extent, especially in the Middle East and North Africa, on oil revenues to develop their economies. Any change upward or downward in oil prices would directly affect the progress

of these economies. Thus the stability of OPEC and its strength to control the market price is a significant factor in socio-economic growth in the individual OPEC countries.

The economies of most OPEC countries are claimed to have risen from the conditions of the rentier state; that is, countries which receive substantial amounts of external rents on a regular basis, paid by foreign governments or concerns. The distinguishing characteristic of the rentier state is that: *The oil revenues received by the governments of the oil producing and exporting countries have very little to do with the production processes of their domestic economies. The inputs from the local economies other than raw materials are insignificant.* The public sectors in the rentier states receive rents on a scale that affect the pace and pattern of their economies. The governments could thus embark upon large public expenditure programmes without resorting to taxation and without running into drastic balance of payments or expenditure problems. Since oil revenues typically increase at a spectacularly faster rate than the gross national product of local economies, the public sectors of these countries expanded rapidly. With this expansion the public sector become the dominant factor in the economy.

The generation of a valuable product by an industry that employs very few people and uses very few local resources, made participation in productive economic activity in the modern sector extremely low. There is no nexus between production and income distribution, since revenues accrue directly to the government, not through any production but from oil taxes which come from outside the economy. Government expenditures and development programmes become totally dependent upon oil revenues and consumption patterns become geared to the use of imported commodities.

Libya is seen as a good example of a rentier state; its economy is very

susceptible to changes in oil revenues, and any reduction in oil revenues would reduce the country's economic growth. Part Two of this thesis sets out to investigate such claims and to measure the extent to which oil revenues have affected the Libyan economy.

1.1 The Pre-OPEC oil market

The crude oil market, before the creation of OPEC, differed from most other markets of primary commodities in being an oligopolistic market. In 1950, seven oil companies virtually controlled the international oil business. The producing group of which they were members was singularly successful. The seven major oil companies were British, Dutch, and American by nationality, but their interests and loyalties were international. Each has gone through name changes, but by their present designation the companies were: British Petroleum, a British company with substantial government ownership; Royal Dutch/Shell, an Anglo-Dutch firm; and Mobil, Exxon, Socal, Texaco, and Gulf of the United States. A small French company with less influence is the Compagnie Francaise des Petroles (CFP).

These companies controlled virtually all of the oil reserves in the under-developed oil-exporting regions of the world. In 1960 these companies were marketing, almost single-handedly, all the oil production of Iran, Iraq, Saudi Arabia, Kuwait and Venezuela, totalling almost 8 mb/d and constituting nearly 86.7 per cent of world crude oil exports at that time [Al-Otaiba 1975 p.11]. The "Majors" exercised joint maximizing behaviour by programming production to reduce excess supplies and by honouring marketing areas. Production programmes were implicitily suggested and explicitily agreed upon; information on company plans and policies was transmitted through the inevitable interchanges within the maze of interlocking joint ventures in concession areas. This control over the resource base made it possible for the companies to avoid the over production that would have tempted price competition in world markets; crude oil prices were fixed administratively rather than determined by market conditions or by the forces of supply and demand. It also

restricted the bargaining power of the host governments which faced unified or single bidders for concessions.

The later shift in the bargaining power between OPEC and the oil companies came partly because of the skill and cohesiveness of OPEC, but primarily because of erosion of the power of the international oil firms caused by the presence of the "Independents" in the oil market. In 1940 the seven majors and CFP were the only significant producers in the Middle East. The seven majors dominated refining and transport as well as crude oil production; in 1950 they owned over 70 per cent of the world's refining capacity, excluding the U.S. and the Communist countries, as well as every important pipeline and about two-thirds of the world's privately owned tanker fleet. Although some of these had been acquired by purchase, the companies themselves made an overwhelming proportion of the investment required for the rapid increase in world oil consumption which, even excluding the U.S, had grown some three and a half times between the wars [U.S Federal Trade Commission 1952 pp.25-28]. This powerful position of the majors, together with their superior financial ability to withstand bouts of price-cutting and depressed market conditions (such as those that prevailed in the later 1920s and early 1930s),as well as the high cost of creating a new distribution system, made the successful entry of newcomer independents expensive and difficult, quite apart from any market-sharing and cartel agreements that may have existed.

For over three decades, that is till the late 1960s, the major oil companies were able to have and enjoy the sources of power to which reference has been made thanks essentially to legal factors, that is, to the concessions and other contractual arrangements in their hands, and the security they felt as a result. But they also had all the other essentials of power; finance, technological supremacy, organization, appropriate

facilities, in addition to political support by their governments. The combined weight of all these components of power gave the companies the added power to intimidate and later effectively to influence the governments of the oil-producing countries.

This situation remained largely unchallenged until the mid 1950s. By this time ten U.S. independents or "newcomers" were present, though their production was proportionately small. By 1955 seven more U.S. oil firms were active, the majority of them brought in through the Iranian Consortium. Table (1.1) shows that from 1950 to 1966 the share of the seven majors in total crude-oil production outside of Canada, the U.S. and the Communist countries fell from 85 per cent to 76 per cent, while that of the new independent companies and of the State owned companies rose correspondingly. Between 1965 and 1970, independents increased in number and market share, but the majors continued to produce and market the bulk of the oil.

Table 1.1

The Seven Sisters Crude Oil Production in the World (000 b/d):1950-66

(Excluding US, Canada, USSR, Eastern Europe and China)

Company	1950	%	1960	%	1966	%
1.Standard Oil(NJ)	1,020	25	1,920	17	3,150	18
2.Royal Dutch/Shell	770	19	1,600	14	2,390	13
3.British Petroleum	800	20	1,500	13	2,500	14
4.Gulf Oil	300	7	1,170	10	1,780	10
5.Texaco	240	6	790	7	1,440	8
6.Standard Oil of California	180	4	560	5	1,480	8
7.Mobil Oil	140	3	570	5	950	5
Total Seven Majors	3,450	85	8,110	72	13,690	76
Independent Companies	620	15	3,120	28	4,230	24
Total	4,070	100	11,230	100	17,920	100

Source: Penrose [1968], p.78.

1.2 Price-basing points:

Until World War II, the oil companies fixed the oil prices throughout the world to the prices prevailing in the Gulf of Mexico, regardless of the crude's place of origin or cost of production. Under this single base point pricing, also known as "*Gulf-plus*", the price of Arabian Gulf oil was determined according to the oil prices at the ports of the Gulf of Mexico in the United States, plus the freight charges of shipping that oil from the Gulf of Mexico to the point of sale. Under this arrangement, the Arabian Gulf oil buyer who was located near the area would pay more for the oil than another buyer located near the Gulf of Mexico, since the first buyer would be charged a fictitious shipping cost as if the oil originated at the Gulf of Mexico. On the other hand, the buyer located near the Gulf

of Mexico would pay for the Arabian Gulf oil the price prevailing at the Gulf of Mexico plus a freight cost from the Gulf of Mexico. This pricing system was used by the oil companies because, during that time and until some time before World War II, Texas supplied the largest share of oil exports as well as production, and thus, naturally, U.S. oil prices determined the World oil prices.

However, the Gulf-plus pricing system became invalid when the Middle East's potential as an important producer and exporter of crude became apparent. The Gulf-plus system came to an end when, in 1944, the British government objected to paying "*phantom freight*", or fictitious freight costs, from the Gulf of Mexico to the Middle East on fuel oil purchased by the British Navy from a Middle East refinery. As a result of this British protest, the Arabian Gulf became a second oil price basing point but at the same level as Gulf of Mexico prices. Under that system "*phantom freight*" to buyers closer to the Middle East was eliminated; however, the system continued to yield identical delivered price for each destination regardless of source of supply [Blair 1976].

With the elimination of the freight cost and the establishment of the two basing point price system, the price of Middle East oil of the "*marker crude*" (Arabian light, 34-34.9 gravity, f.o.b. Ras Tannura) became equal to the Gulf of Mexico price at $1.05 per barrel. With the addition of freight costs to the Middle East, oil from Ras Tannura and oil from the Gulf of Mexico were priced equally at a point in the mid-Mediterranean. Buyers to the east of this mid-point could buy their oil cheaper if they bought it from the Middle East, while buyers to the West found it to their advantage to buy U.S. oil. However, with increasing Middle East oil production, and the growing importance of and rapid increase in the West European market for oil, the oil companies moved the "*equalisation point*"

westward to England and then, in 1948, to the Eastern seaboard of the United States, north of Cape Hatteras.

Despite the fact that oil prices remained low, the crude oil prices (and to a lesser extent the price of refined petroleum products), mainly from the Arabian Gulf region, continued to slump during the 1940s, 1950s and the 1960s [Issawi and Yeganeh 1962 p.65]. The direct effect of the cuts in posted prices was the decline in the revenue of the oil producing countries. These reductions in crude oil prices were strongly criticised by the Governments of the oil producing countries. This was the key point which caused the formation of OPEC, as will be explained below.

1.3 The creation of OPEC:

OPEC was founded to safeguard the interests of the petroleum exporting countries in the face of companies that controlled prices and had lowered them several times.

OPEC was created in 1960, although the idea of combining within the framework of such organization was not a thought which came overnight. It had occupied the minds of experts and politicians in the oil-exporting countries for several years before. In 1949 Venezuela, as a major oil producer and exporter, decided to approach the oil-exporting countries in the Middle East in order to make allies instead of competitors in an area whose importance was rapidly increasing [Rouhani 1971 p.76]. Several meetings followed the Venezuelan Government's dispatch of three delegations to some Arab oil producing countries in 1949. Meetings were held between Middle East producing countries and Venezuela on one hand, and between Arab producers through the Arab league, or individually as in the case of cooperation between Saudi Arabia and Iraq, on the other hand. Member countries were enthusiastic about co-ordination of oil policies and the establishment of an alliance between the oil-exporting countries.

The direct cause that led to the founding of OPEC was the large reduction in posted prices that took place in 1959 and 1960 [Seymour 1980 p.25]. These reduction decisions, which were taken by oil companies independent of the host governments' views, undermined the development plans of the countries concerned in spite of the realisation of planned large increases in production which had been expected to boost budget revenues. The decrease in income per barrel thus came as a surprise and the first reduction of February 1959 raised a wave of public protest in the oil-exporting countries. Voices were raised demanding restraints on the companies' ability to control prices, and therefore the oil revenues of the producing countries.

Despite the strong position taken by the oil-exporting countries on this issue, the major companies went ahead and cut prices again in August 1960. The exporting countries responded by founding OPEC one month after this reduction [Al-Chalabi 1980 p.67]. The 27 U.S. cents per barrel cut in price in 1959 resulted in a loss of revenue by major Middle East oil-exporting states in the ten year period 1961-1970 estimated at $4,000 million.

The objectives set by the OPEC founders (Venezuela, Saudi Arabia, Iran, Iraq and Kuwait) were designed to unify their oil policies, and to lay down the best means for safeguarding their interests, individually and collectively, as well as to stabilise prices, with due consideration for the interests of both producing and consuming nations [OPEC Resolutions 1 and 2 Sept. 1960]. These objectives show that OPEC was not created with a view to raising prices by creating an artificial shortage in oil supplies in world markets. It was designed to be a stable long-lived organization concerned with the interests of its members and contributing to the stability of world trade by considering international interests [AL-Otaiba

1975 p.60].

OPEC influence has grown, especially during the 1970s. OPEC has become a force to contend with in the petroleum industry, illustrated by the quadrupling of crude prices in 1973-74 and their doubling in 1979. Debates erupt over very basic matters, such as the degree to which OPEC is a cartel responsible for propping up world prices, or whether OPEC simply ratifies prices determined in an environment which is approximately competitive.

1.4 Economic interpretations of OPEC behaviour:

Most Western economists such as Levy [1974], Adelman [1981], Kennedy [1974], Kalymon [1975], Pindyck [1978] and many others, refer to OPEC as a cartel, while OPEC representatives and Arab scholars commonly argue that OPEC is not a cartel. However, the 1970s showed that OPEC undoubtedly controlled the price of oil, while this could hardly be said for the first half of the 1980s. Output quotas have been in practice since 1982, while they were not important as such during the 1970s. I shall now assess the above views on OPEC.

A- OPEC is not a cartel:

Teece [Griffin and Teece 1982] argues that several important OPEC producers set oil production with reference to budgetary requirements and internal and external political constraints. If export receipts plus foreign earnings are such as to satisfy expenditure requirements, oil production policies will be determined by conservation considerations, where conservation involves shutting in production for future generations, even if this is not consistent with maximizing the present value of oil reserves. Conversely, if export receipts plus foreign earnings are such that expenditure requirements are not being met, production and capacity will be expanded, so long as technical conditions permit. Expenditure requirements are determined by applying some percentage growth factor to

last year's expenditure levels, where the growth factor is always positive, or very nearly so.

For some important OPEC producers such as Saudi Arabia, Kuwait, Libya, Qatar, and the United Arab Emirates (UAE), the relationship between current price and current output is best represented by a backward bending supply curve for the short run. Oil revenues can be considered as the source of funding for potential investment projects, which can be arrayed along a representive marginal efficiency of investment schedule (see Figure 1.1). If a country is unwilling to invest for returns less than r^*, then investment needs are limited by I^*.

In Figure (1.2) below, if oil production decisions are made in order to meet the investment objective represented by I^*, the increases in world price (from P_0 to P_1) in the current period will tend to result in reduced production (Q_0 to Q_1) in the current period, and conversely. The supply schedule thereby generated will be backward bending, at least over the relevant range. This indicates that the monopoly price level is not exposed to the hazards of cheating, just so long as oil revenues (plus other foreign earnings) meet budgetary needs. Budgetary needs are in turn a function of absorptive capacity, which is limited where the GDP of the economy is small in relation to oil revenues, or where the infrastructure is inadequate to support rapid escalation in consumption and investment levels.

The fact that oil prices increased from $3.36 per barrel in 1971 to $17.69 per barrel in 1980 (1975 = 100) cannot be explained by this model. The absorptive capacity, in the main producing region (the Gulf), would not rise as fast as the oil prices.

Figure 1.1

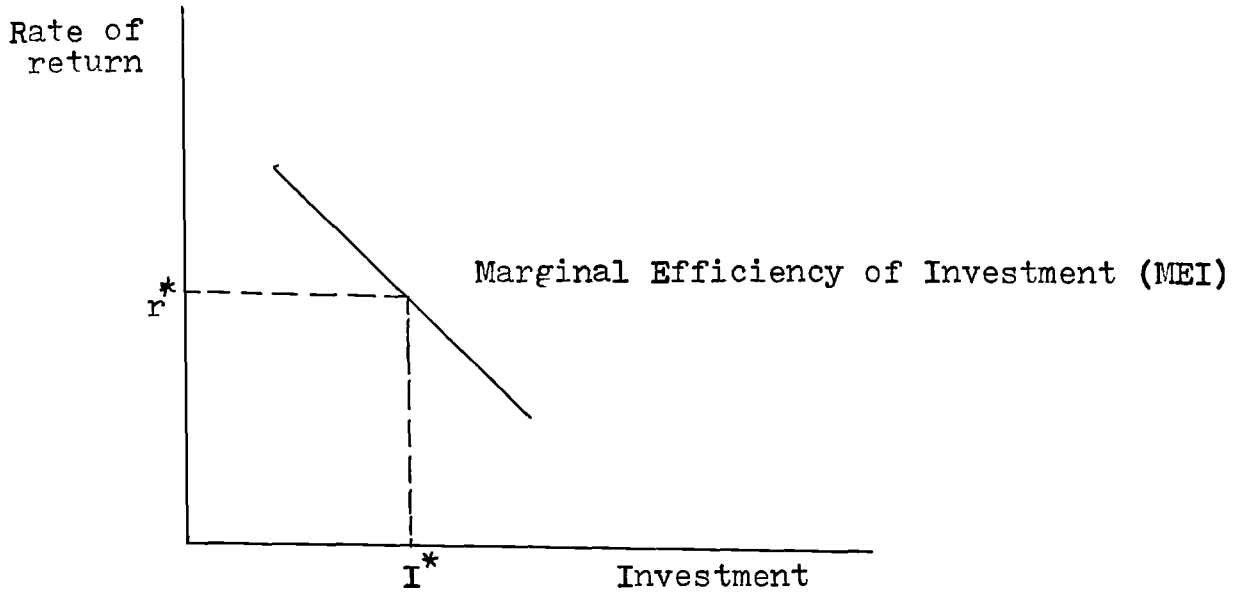
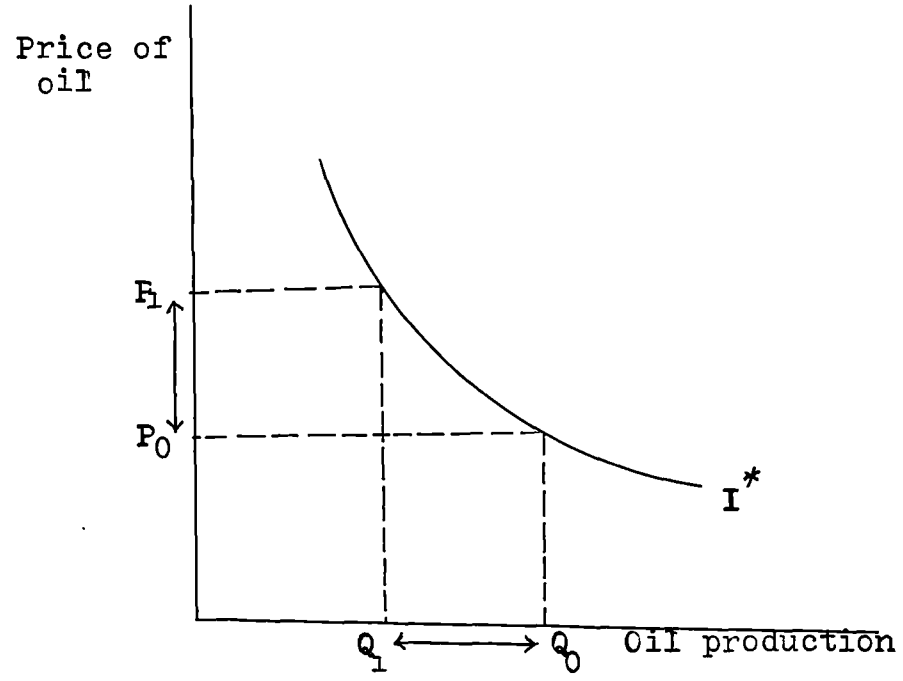


Figure 1.2



B- OPEC as a cartel:

A cartel is an open, formal collusive arrangement among firms in an oligopolistic market to cooperate with regard to agreed procedures on such variables as price and output . The result is diminished competition and cooperation over such objectives as, for example, joint profit maximization or avoidance of new entry. In general, side-payments must be made between cartel members in order to induce adherence to these objectives.

In many countries in Europe, cartels are common and legally acceptable. In the United States, most collusive arrangements, whether secret or open cartels, were declared illegal by the Sherman Antitrust Act, which was passed in 1890. However, this does not mean that such arrangements do not exist. For example, widespread collusion to fix prices occurred among American electrical equipment manufacturers during the 1950s, and when the collusion was uncovered a number of high executives were tried, convicted, and sent to jail. Moreover, collusion of this sort is not limited to a single country; some cartels, like that in quinine in the early 1960s, are international in scope [Mansfield 1971].

To illustrate how firms collude, consider the electrical equipment manufacturers just mentioned above. During the 1950s there was widespread collusion among about 30 firms selling turbine generators, switchgear, transformers, and other products with total sales of about $1.5 billion per year. Representatives of these firms got together and agreed upon prices for many products. The available evidence indicates that both prices and profits tended to be increased by the collusive agreements, or at least until the firms were prosecuted under the antitrust laws by the Department of Justice.

If a cartel is established to set a uniform price of a particular product, the marginal cost curve must be estimated for the cartel as a

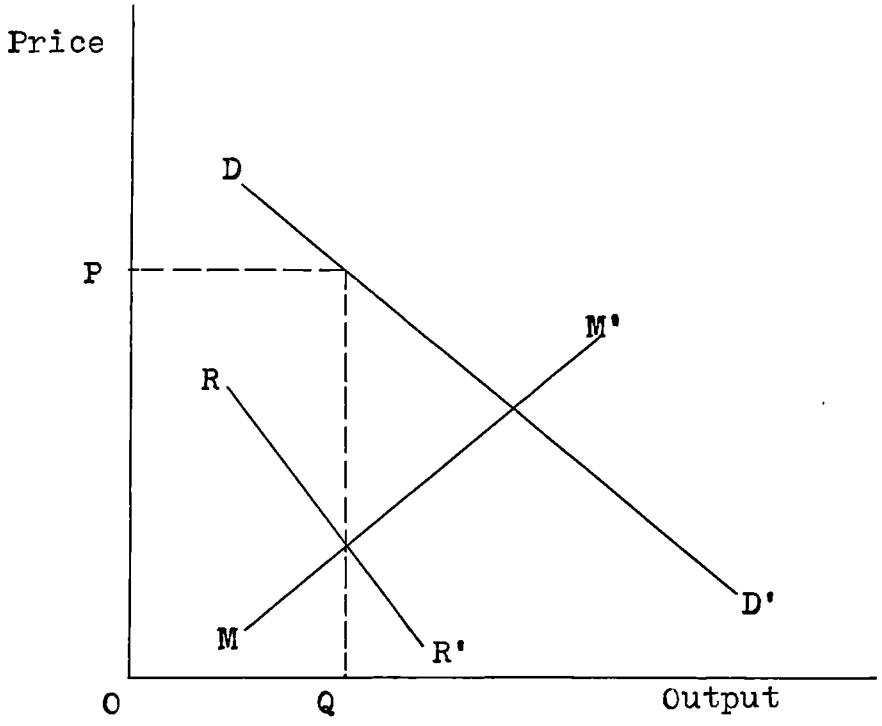
whole. If input prices do not increase as the cartel expands its output, this marginal cost curve is the horizontal sum of the marginal cost curves of the individual firms. Suppose that the resulting marginal cost curve for the cartel is MM' in Figure(1.3). If the demand curve for the industry's product is DD', the relevant marginal revenue curve is RR', and the output that maximizes the total profit of the cartel members is OQ.

Thus, if it maximizes cartel profits, the cartel will choose a price of (O P), which, of course, is the monopoly price. The cartel, in fact, acts like a monopolist with a number of plants or divisions, each of which is a member firm [Mansfield 1974 p.508].

If the cartel aims to maximize its profits, it will allocate sales to firms in such a way that the marginal costs of all firms are equal. But this allocation is unlikely to occur in reality. The allocation process is a bargaining process, and firms with the most influence and the shrewdest negotiators are likely to receive the largest sales quotas, even though this decreases the total profits of the cartel. Moreover, high-cost firms are likely to receive larger sales quotas than would be the case if total cartel profits were maximized, since they would be unwilling otherwise to stay in the cartel. In practice, it appears that cartels often divide markets geographically or in accordance with a firm's level of sales in the past.

With reference to OPEC, Adelman [Resources and Energy 1978 p.7] for example, suggested that the best approximation to a model of the OPEC cartel was somewhere between two polar cases of cartel operation. One case was the residual firm which lets everybody else maximize profits individually, choosing their own production levels. The large seller then makes up the difference, varying his production to control the price. The larger the market share of the residual seller, the easier for him to carry

Figure 1.3



the load. At the other extreme, the model proposes all the nations getting together to agree to some kind of price and output combination which suited nobody perfectly, but was accepted as the best compromise. The firms or sellers may wobble from one model to the other in trying to escape as many of the rigours of competition as possible. The number of expedients is almost infinite.

The dominant producer, or the cartel core if it is a group of producers, depends for success on cooperative behaviour within the core; the dominant producer, on the other hand, does not depend on collusion, either explicit or implicit, for the generation of rents. Moreover, the divergence in the interests of the individual members, may lead to violation of the quota agreement by some members within sub-groups, and some other members may react in a way so as to accommodate the increase in other members output by reducing their own output. These matters, where cartel interests oppose individual interests, cannot be explained by cartelization theory. That is why an alternative method is needed to clarify such paradoxical behaviour.

1.5 OPEC sub-groups:

Although most economists view OPEC as a cartel, they agree on dividing the organization into groups. They generally view the Arab peninsula states as a residual supplier, but they disagree on particular countries. Considering Saudi Arabia or Saudi Arabia and the other Gulf states as a residual supplier, is the object of a number of models such as; Levy [1974], FEA [1974], B-M-S [1975], Kalymon [1975], Adelman [1981] etc. Hnyilicza and Pindyck [1976] divided OPEC into saver countries (Saudi Arabia, Libya, Iraq, Abu Dhabi, Bahrain, Kuwait, and Qatar) that have little immediate need for cash and would thus use a low rate of discount in computing a sum of discounted profits from oil extraction, and a second group of spender countries (Iran, Venezuela, Indonesia, Algeria, Nigeria,

and Ecuador) with large cash needs and a higher rate of discount.

Daly, together with Griffin and Steele [Griffin and Teece 1982], divided OPEC countries according to their characteristics into the following three groups:

(a)Output Maximizers (b)Price Maximizers and, (c)The cartel Core.

(a) The Output Maximizers subset of OPEC members consists of Nigeria, Indonesia, Iraq, Ecuador and Gabon. These countries have relatively lower total oil reserves, relatively higher populations, and greater pressures for internal economic development. Table 1.2 shows that the share of these countries in OPEC oil reserves in 1978 was only 15.89% of the total, while their population was 76% of the total.

Table 1.2

OPEC Output Maximizers: 1978 Population and Reserves

Country	Population(m)	Proved Reserves(mb)
1.Nigeria	91.17	18,700
2.Indonesia	141.28	10,000
3.Iraq	12.65	34,500
4.Ecuador	4.35	5,675
5.Gabon	0.54	1,500
Share of Total OPEC	76.02%	15.89%

Source: World Energy Industry, Vol. 1 No.1 1978.

Nigeria, for example, with a population of 91 million, has only 18,700 million barrels proved reserves in 1978. Its economy experienced a rather dramatic expansion following the petroleum boom of 1973-75. An important factor in its economic recovery during fiscal year 1979 was the rapid revival of oil exports due, first to more competitive pricing and second, to the interruption of oil supplies from Iran. The Nigerian government took a number of steps to bring expenditures into line with revenues.

Those steps included a drastic reduction in public investments, the imposition and tighter enforcement of import restrictions, and borrowing $750 million in the Eurodollar market [World Bank, *Annual Report* 1979 p.39]. The cuts in public expenditures directly affected the construction sector, particularly in urban areas, creating recessionary conditions and threatening an increase in urban unemployment.

Another example is Indonesia, one of the poorest countries in East Asia, and with the largest population within OPEC. This country has made large strides since the economic dislocation of the mid-1960s. There is no doubt that a large majority of the population has benefited from the rapid economic growth that has occured, partly as a result of increased oil revenues. Still, large problems remain, of which the uneven distribution of the population, dependence on imports of food, a low level of industrial development, and difficult transportation and communication problems in the far-flung archipelago are only a few. In an attempt to make its own non-oil (especially manufacturing) sectors more competitive, the government has devalued the rupiah. While the need for investment capital is large, Indonesia is watching its debt service carefully, the size of the foreign inflows it can absorb is, therefore, closely linked to the borrowing terms it can obtain.

The countries of this group are motivated to increase production of crude oil at the OPEC-determined price in order to further their economic development. As long as the other members of OPEC, in particular the Cartel Core, are willing to limit output in order to maintain high prices, the OPEC Output Maximizers, according to Daly [1982], should have the same incentive as non-OPEC producers to maximize output up to the point where price equals marginal cost.

(b) The OPEC Price Maximizers are Iran, Algeria and Venezuela. According

to this classification these are in an intermediate position between the Cartel Core and the Output Maximizers. They constitute 20% of total OPEC population, and about the same percentage of 1978 proven reserves (see Table 1.3). These members, like the Output Maximizers, have relatively large populations and considerable potential for economic development, but unlike other OPEC members their reserves are neither high relative to current production rates (1978) nor do they appear to be capable of significant expansion in the future. The reserves to production ratio (R/P) for Price Maximizers is only half that of the Cartel Core as shown in Table 1.3. At the same time the Cartel Core constitutes only 3.6% of the total OPEC population.

Table 1.3

Some OPEC Countries Data; Population, Reserves and Production as in 1978

Country	Population(m)	Reserves(mb)	Production(mb/d	(R/P)
Price Maximizers:				
Iran	36.64	62,000	5.200	11.923
Algeria	17.25	6,000	1.100	5.454
Venezuela	13.10	18,200	2.165	8.406
Share of Total OPEC	20.37%	19.47%	8.465(mb.d)	10.183
Cartel Core:				
Saudi Arabia	6.89	153,100	8.295	18.456
Libya	2.73	25,000	1.975	12.658
Kuwait	1.18	70,100	2.095	33.460
Qatar	0.23	5,600	0.480	11.666
UAE	0.83	32,425	1.831	17.708
Share of Total OPEC	3.61%	64.64%	14.676(mb.d)	19.502

Source: US Department of Energy, *Monthly Energy Review*, Feb.1980.

During periods of short supply, the activities of the Price Maximizers aid the Cartel Core members since they can satisfy their target revenues at the higher prices by reducing output. While the Price Maximizers tend to produce close to full capacity, they do all that is in their power to avoid reducing the price of their oil and thus promote price stability. But if non-OPEC supply increases, the activities of the Price Maximizers can become increasingly destabilizing to OPEC. Their output can become a larger fraction of OPEC's total production as the Cartel Core cuts its own production in order to prevent price declines, and if prices fall, the Price Maximizers try to increase output in order to keep oil export

revenues from declining. The point is that Price Maximizers are always trying to reach their target incomes by decreasing production depending on the current situation, and thus they move from being a factor promoting Cartel stability (like the Cartel Core) to a factor promoting instability (like the Output Maximizers) when prices decline.

(c) The Cartel Core consists of those OPEC members with vast oil reserves, relatively small populations (see Table 1.3 above),and a physical geography characterized by barren desert regions. The absorptive capacity of most of these economies is quite limited and consequently these countries, facing no internal development pressures, can accept much lower oil production rates to sustain OPEC's price. Saudi Arabia, for example, with the largest population in the group (6.89 million in 1978) has only 1/13 of Nigeria's population and 1/20 of Indonesia's, while its production is twice that of these producers. The Saudi economy is dominated by the oil sector, which accounted for 60% of the nations GDP on average during 1973-78 [SAMA, *Annual Report* 1979]. The other 40% of the Saudi GDP is chiefly generated through activities created and funded by oil revenues. Oil revenues rose from $4,340 million during fiscal year 1973 to $22,573.5 million during fiscal year 1974. No one expected the Saudi economy's absorptive capacity to quadruple in one year simply because oil prices rose by more than 400%. The government's total expenditure was about one-third of total revenue in fiscal year 1974-75. The difference between revenue and expenditure for that year (Million Riyals 100,103 - 32,038 = 68,065) had to be invested abroad. The country could not invest all of its financial capital within its borders because the supply of other 'co-operant' factors could not be augmented as easily as the supply of financial capital.

Johany [1980 p.63] argues that in the process of trying to adjust the Saudi economy to the increased oil revenues two problems emerged. One was

an increase in the rate of inflation, and the other was the awareness on the part of the Saudis that investing their funds in foreign countries was, and is, a very risky endeavour. Thus Saudi Arabia, as well as the other Cartel Core members, can adjust their production levels to meet their development requirements and other expenditure. This is exactly what Daly ment by the Cartel Core. In practice, however, the Arabian peninsula members (Saudi Arabia, Kuwait, Qatar and the United Arab Emirates) generally prefer to maintain prices during periods of slack demand for OPEC oil by carrying more excess capacity. Their preferences are relatively lower prices than are demanded by other OPEC members since, in part for political reasons, they stand to lose more in the long run, due to their large reserves, if profitable substitutes for OPEC oil are developed in the future. Libya, however, has at various times in the past acted more like a price maximizer, insisting upon excessively high prices for its own oil, using its advantages of higher quality oil and greater proximity to European markets. Libya is included with the Cartel Core since its use of oil revenue for internal development has been very low, suggesting it can easily reduce output to help stabilize the Cartel during periods of low demand.

It is clear from the models mentioned, and which will be reviewed in some detail that if OPEC is a real cartel, it will maximize its revenues if all members adhere to the jointly agreed price structure and output quotas. The problem is that the interests of each member may diverge from the interests of the group. For example, Nigeria violated the OPEC price agreement by reducing the price of its crude twice following the British National Oil Corporation (BNOC) price reductions in March 1983 and October 1984, regardless of the OPEC official price. Another example showing the difficulty in formulating any OPEC sub-group divisions, is that when the

demand for OPEC oil fell from about 23 mb/d in 1981 to 19 mb/d in 1982, the burden of reduction in output to prevent the fall in price was shouldered by Saudi Arabia and to some extent Kuwait and the UAE, not by all Cartel-Core members as assumed by Daly. Thus the problem is that the individual interests may diverge from the organisation interests. In order to maintain OPEC stability, the violation of price-output agreements must be met by a sacrifice from another member or other members of the organisation. This is the case where cartelisation theory can offer no explanation. The aim of this thesis, as far as OPEC is concerned, is to find an acceptable and more comprehensive interpretation of such paradoxical behaviour. In order to develop a wide ranging discussion of OPEC models and to introduce my assessment of OPEC behaviour, it is essential to begin with a discussion of exhaustible resource theory. This is the task of the next chapter.

CHAPTER 2: THE ECONOMICS OF OIL WEALTH

The prime objective of the developing countries at the present time is to attain the main goal of development, that is creating a mature and diversified economic base capable of sustained economic growth. This process of economic development is made possible when the means, namely foreign exchange, for importing producer capital goods, services and technical know-how are available.

Although most OPEC Countries have achieved very high per capita incomes, they are essentially developing countries. They share with the rest of the developing world the features of underdevelopment; they are economies engaged mainly in primary production and have labour forces characterized by low productivity, etc.. Although the economies of OPEC Countries have experienced considerable growth in the oil export sector, the other sectors of these economies remain largely underdeveloped.

Crude oil, which is the only source of foreign exchange in some OPEC Countries, especially the OPEC-Core, is an exhaustible resource. The revenue stream of oil ends with the last barrel produced. There is no mechanism to generate a continuous revenue as in the case of renewable resources, such as agriculture or natural forests. This fact calls for its rational utilization so that the maximum benefit is obtained from it. Since, as a result of underdevelopment, the economies of most OPEC Countries are extremely skewed towards heavy dependence on the oil export sector, rational utilization of crude oil necessitates linking the production of this exhaustible resource with the needs for developing a wide and diversified economic base.

In this chapter, I begin with a discussion of the theory of exhaustible resources since its inception by Hotelling in 1931, with particular

reference to the rate of depletion, user costs, and the price of the resource. The second section will concentrate on the distribution of oil wealth between present and future consumption, between the oil generations and future non-oil generations with reference to Core-OPEC Countries (the nations most highly dependent on the value of oil resources).

2.1 The economics of exhaustible resources

Most resources are so abundant that they are not classified as depletable. Total exhaustion of salt, for example, is almost inconceivable. Similarly, lead, tin, zinc, and many other minerals will, for all practical purposes, be available into perpetuity. Even coal will be available for more than 500 years at present utilization rates [Danielsen 1982]. Other resources, however, are used so rapidly that they cannot be replenished. These are classified as depletable resources, and for some, such as oil and natural gas, the time profile of their exhaustion is thought to be only two or three generations.

The theory of depletable resources is unique in that it arose almost entirely from a single article "The Economics of Exhaustible Resources", in 1931, by the American economist Hotelling. His interest in depletable resources was stimulated by the conservationist movement of the 1920s. The conservationists were concerned that resources, renewable and non-renewable, were being used up too fast. Hotelling sympathised with the conservationist point of view, but perceived that resources could be extracted too slowly as well as too fast. In essence, he suggested that there is an optimal rate of resource extraction. His great contribution lay in specifying a methodology suitable for analysing optimal prices and levels of output over time.

Hotelling's thesis underwent a number of refinements and extensions, but for the most part his basic ideas remain intact. In essence, they are that

(1) depletion causes a resource to become more scarce; (2) scarce resources command higher prices than abundant ones; and (3) therefore the price of a depletable resource will tend to rise over time [Hotelling 1931]. Hotelling further contended that a depletable resource would command a lower current price under a competitive market structure than under a monopolistic structure. However, he also recognized that since low prices stimulate consumption, the resource would be depleted more rapidly under competition. Thus, the extraction period and price path followed under a monopolistic system would be fundamentally different from the outcome of competition.

Oil, of course, is exhaustible in the sense that society's stock of the reserve is not physically replenishable. Potential reserves are equal to proved reserves plus secondary and tertiary recoverable reserves. Technology has been used, and will be used, probably more efficiently, to increase the potential reserves. Since actual reserves are subject to search and technology level, then potential reserves, which is the visible part of actual reserves, is used instead. The difficulty in the concept of exhaustion is that geologists estimate the "stock" of oil in terms of "recoverable" reserves. But what is recoverable depends on the cost of extraction relative to the price of oil. Every increase in the price of oil or decrease in the cost of its extraction increases the world's stock of recoverable oil. In addition, an increase in price will lead to more search, and that usually results in increasing reserves.

2.1.1 Basic theory:

The problem that an owner of an exhaustible resource faces, both under competition or monopoly, is how much output should be produced in each period of time until marginal costs of production equals marginal revenues. To answer this question we have to make some simplifying assumptions. The

mathematics could be challenging and might involve multivariate control problems which are very difficult to solve. However, the important results can be derived by using simple algebra.

Pure competition.

Where market prices are initially determined by competitive forces, they may be expected to rise over time. There are two reasons why this is so. First, extraction costs will rise as the giant and super-giant fields are depleted; second, resource owners must be paid a rate of return on money invested in oil reserves which is comparable to the real rate of interest. Among the offsetting considerations is innovative technology that lowers marginal costs and thereby mitigates price increases. Hotelling's classic theory dealt with only one of these determinants of market prices. He was concerned with the net price, and thus abstracted from extraction costs and technology.

Given prices of oil and substitutes and a state of technology in period t, the oil reserves R at (t+1) are equal to reserves at the beginning of period t minus output (q) in period t ie.

$$R(t+1) = R(t) - q(t)$$

Now assume that:

(1) There are many producers and each acts as a perfect competitor.

(2) Marginal cost (MC) is positive.

(3) Marginal cost increases as the stock is depleted. New discoveries may occur, especially costly offshore oil, and thus (MC) is likely to rise. The point is that producers must have some estimate of such events and eventually (MC) must rise.

We assume that the owner of any resource, such as oil, will manage his

stock so as to maximize the discounted present value (DPV) of the time stream of income from his holdings of the stock [Johany 1982 p.34]:

$$DPV = \frac{P_1q_1-C(q_1, R_1)}{1+r} + \frac{P_2q_2-C(q_2, R_2)}{(1+r)^2} + \ldots\ldots + \frac{P_nq_n-C(q_n, R_n)}{(1+r)^n}$$

where P_t and q_t stand for price and output; R_t is the estimated and probable reserves; $C(q_t, R_t)$ are the total costs of mining (not just the extraction costs);and r is the discount rate. The owner of the resource wishes to maximize DPV subject to the constraint that

$$\Sigma_{t=1}^{T} q^t = \bar{R}$$

Here $\bar{R}$ is the given stock of the resource, and T is the time horizon which we assume to be exogenously determined. We now form the Lagrangean expression

$$L = \Sigma_{t=1}^{T} (p_tq_t-cq_t)(1+r)^{-t} + \lambda(\bar{R}-\Sigma_{t=0}^{T}q_t)$$

Differentiating with respect to q_t we then obtain the T first-order conditions [Webb and Ricketts 1980];

$$\partial L/\partial q_t = (p_t-c)(1+r)^{-t} - \lambda = 0$$

$$\text{or } p_t = c+\lambda(1+r)^t$$

Price in period t must equal marginal extraction costs (c) plus an expression $\lambda(1+r)^t$. Scott [Gaffney 1967 p.34] has suggested that this be termed a 'user cost' since it arises from the fact that using the resource in the present eliminates the possibility of its use in the future.

To find the maximum profit or rent for an exhaustible resource we proceed as follows: We select an arbitrary output path $(q_1, q_2, \ldots\ldots, q_n)$ which satisfies the constraint $\Sigma^{T}_{t=1} q_t = \bar{R}$, and then construct an alternative path such as $(q_1, \ldots\ldots, q_t+dq, q_{t+1}-dq, q_{t+2}, \ldots\ldots)$, We now ask the question "When would the producer be indifferent between the two paths?"

The gain in revenue by an increase in production by (dq) is

$$(p_t-c_t)dq$$

and the loss in revenue is;

$$\frac{(p_{t+1}-c_{t+1})dq}{(1+r)}$$

To Hotelling, the choice of the appropriate discount rate was obvious; the market rate of interest. Since inflation was not a problem in 1932, Hotelling was content to state his results in nominal or non-inflation adjusted prices. Today, inflation rates are perhaps more uncertain than oil prices, causing practitioners to favour stating oil price forecasts expressed in dollars of constant purchasing power.

The fact that variable costs are positive complicates things, but the basic idea holds. Mining costs consist of two components:(1) extraction costs or operating costs, and (2) user cost.

Extraction costs are the familiar costs of production. User cost is the opportunity cost to the resource owner of the reduction of the total stock of the resource. That is, the total stock of resources remaining affects the opportunity costs of mining. Since production typically takes place over many periods of time, user cost is determined by the whole future path of costs and prices and not just by current conditions.

In the case of oil, marginal production costs (MC) are close to zero, but user cost, $\lambda(1+r)^t$, is positive. This means that positive output in each

period implies that price must rise faster than the rate of interest, since

$$P_{t+1} - P_t(1+r) = \lambda(1+r)^t$$

$$\text{when } MC_t = MC_{t+1} = 0$$

Monopoly.

For the monopolist facing zero production costs, Hotelling noted that marginal revenue, which will be less than price, will rise over time at the rate of interest [Griffin and Teece 1982]:

$$MR_{t+1} = MR_t(1+r) \text{ and } MR_{t+2} = MR_{t+1}(1+r)$$

But user cost $\lambda(1+r)^t$ is positive so that,

$$MR_{t+1} - MR_t(1+r) = \lambda(1+r)^t$$

This is under the assumption that MC=0. Obviously with marginal revenues rising, prices will rise, but the rate of increase depends on the nature of the demand curve. In the usual textbook case of the linear demand curve, the initial price will be higher under monopoly and rise at a slower rate than under competition. Figure 2.1 contrasts the competitive price path with the monopolist's. High initial price promotes more initial conservation, enabling relatively more production and lower prices in the future. This example supports the claim, "the monopolist is the conservationist's best friend" [Dasgupta and Heal 1979 p.329]. While this may be true, I simply note that the monopolist exacts a huge fee for performing this rationing function and that the monopolist's price path distorts intertemporal resource allocation.

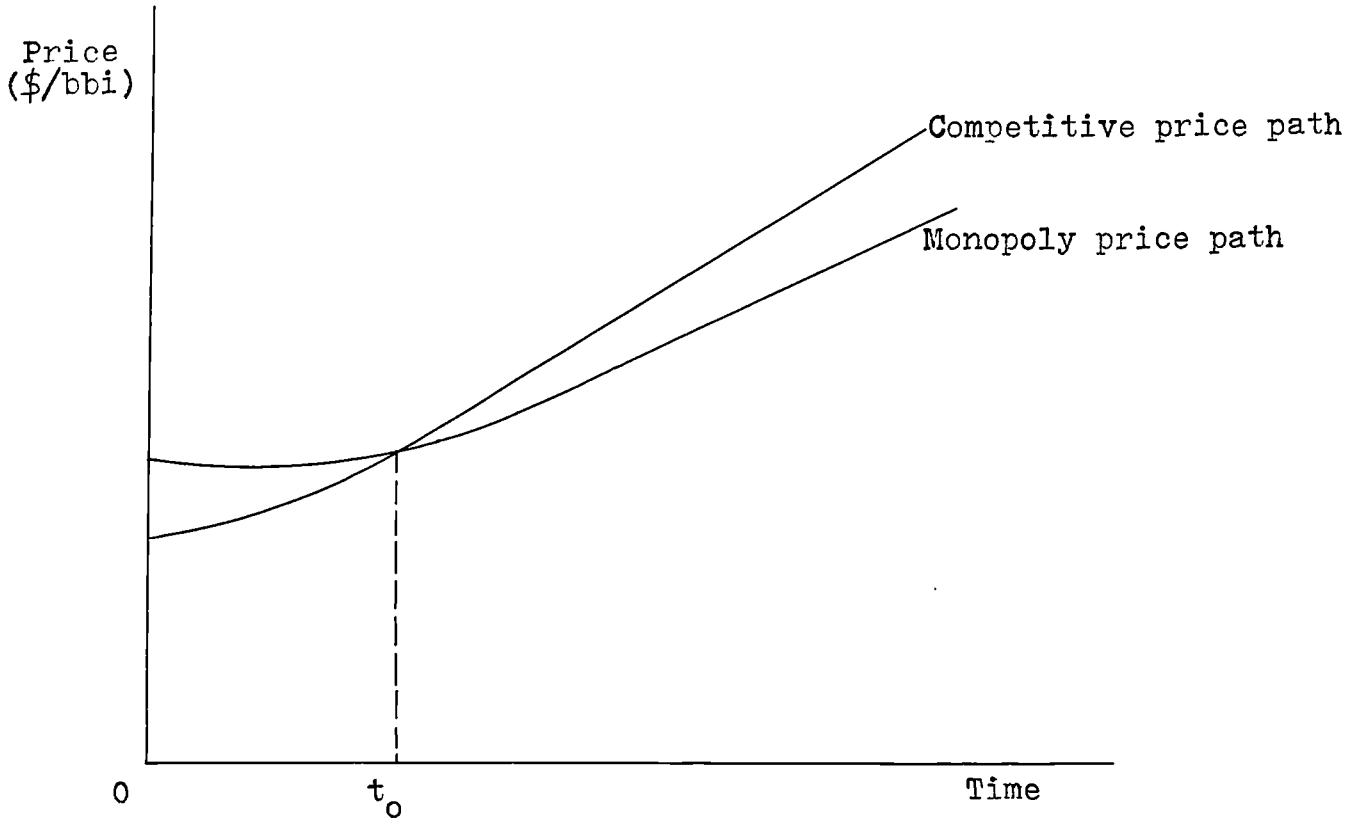


Figure 2.1 Possible monopolistic versus competitive price paths.

2.1.2 User costs:

User costs, as defined above, play an influential role in oil price determination, irrespective of whether one posits monopoly or competition. The increase in user costs leads to the increase in the resource price. This is easily derived from the equation: $P_{t+1}-P_t(1+r) = \lambda(1+r)^t$. Since user costs are based on expectations of present and future supply and demand conditions, it is important to look at four such factors which influence producers' perception of user costs.

(1)Rates of discount: The market rate of interest or nominal rate of interest is the percentage increase of the number of dollars invested, making no allowance for inflation. The real rate of interest is the percentage of increased (or decreased) purchasing power earned as a result of the investment. For example, if the nominal interest rate (the price of borrowing money) is 15 percent per year, and the general price level rises at an annual rate of only 12 percent, then the real rate of interest (the earned increase in purchasing power) is 3 percent. There are problems in deciding which nominal interest rate and which price index to use in making actual adjustments for inflation, but investors are naturally interested in the real rate of interest, not the nominal rate, so it is important to make some adjustment. The long-term historical real rate of interest is thought to be on the order of 3 percent per year [Griffin and Teece 1982 p.17]. However, short-term inflation-adjusted real rates of return may vary from negative rates to positive rates as high as 10 or 12 percent, or more.

To illustrate the effects of changes in the real discount rate, Figure 2.2 describes price paths under three alternative discount rates. From period 0 to t_o, producers employ a very high discount rate of 25 percent in anticipation of nationalisation. This means high rates of production and low prices. Now suppose the risk of nationalisation abates and the

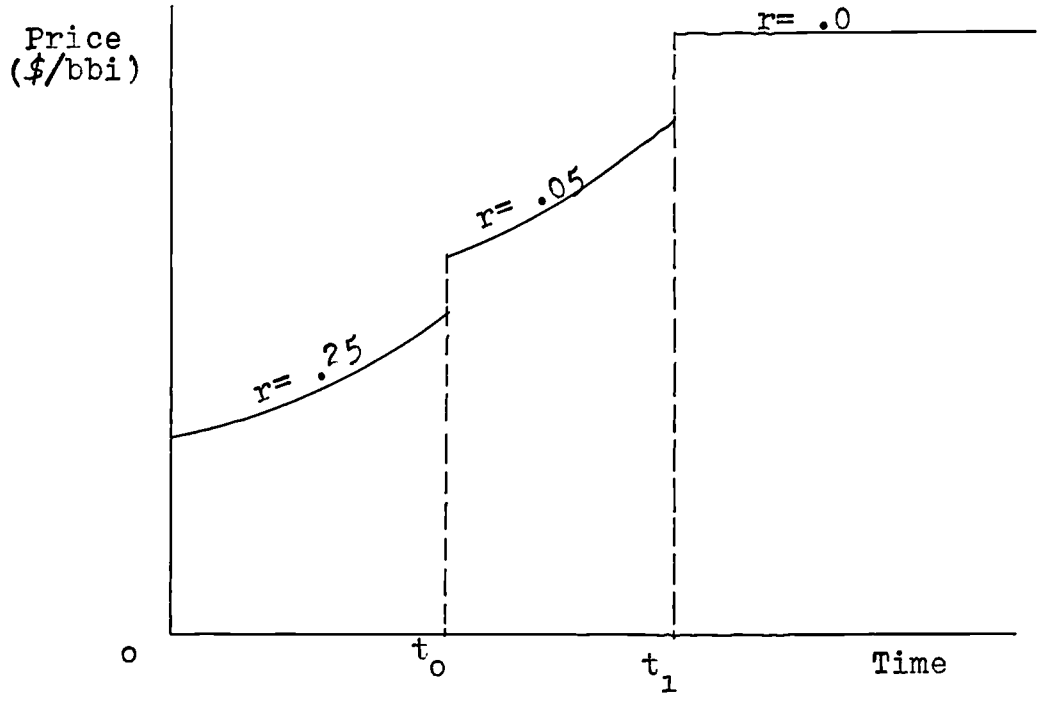


Figure 2.2 Price paths under alternative discount rates.

discount rate is reduced to 5 percent. Finally, in period t_1 the state obtains control and adopts a zero discount rate. With a zero discount rate, the user costs are equal over time

(2)Backstop technology: The reason a particular good is used, and the reason for the extent to which it is used, depends on its cost relative to that of more and less viable alternatives. Because of the vast potential supplies of crude oil from tar sands, oil shales, and coal, economists have been prompted to consider what their impact will be on the price of petroleum. This is the essential idea concerning the concept of backstop technology. This factor will be in effect when $P_{t*} = P_{t**}$ where P_{t*} is the price of oil and P_{t**} is the price of the backstop fuel.

Backstop technology, therefore, refers to technology developed for resources that are available in super-abundance. Solar, wind, and tidal power are good examples of renewable resources which may provide a basis for the backstop to petroleum [Danielsen 1982].

We may assume that the reserves of oil substitutes, such as coal and nuclear energy, become infinitely elastic at some price P^*. Obviously, these resources are non-renewable, but the reserves base is assumed so large that their user costs are effectively zero. Thus at price P^* virtually unlimited supplies will be available. As Figure 2.3 indicates, the price paths of oil are substantially altered over time by the existence of a backstop. No longer does the price continue to rise indefinitely at the rate of interest. The solid line price path depicts a world of perfect foresight. The price increases at rate r until it reaches P^*, at which time the backstop fuel would meet all demand at the price P^*. The dotted line occurring after t_o shows how prices might overshoot while the backstop fuel industry is adjusting to meet demand (period t_o to t_1). After t_1, oil prices are constrained to price P^* whether or not there is a price

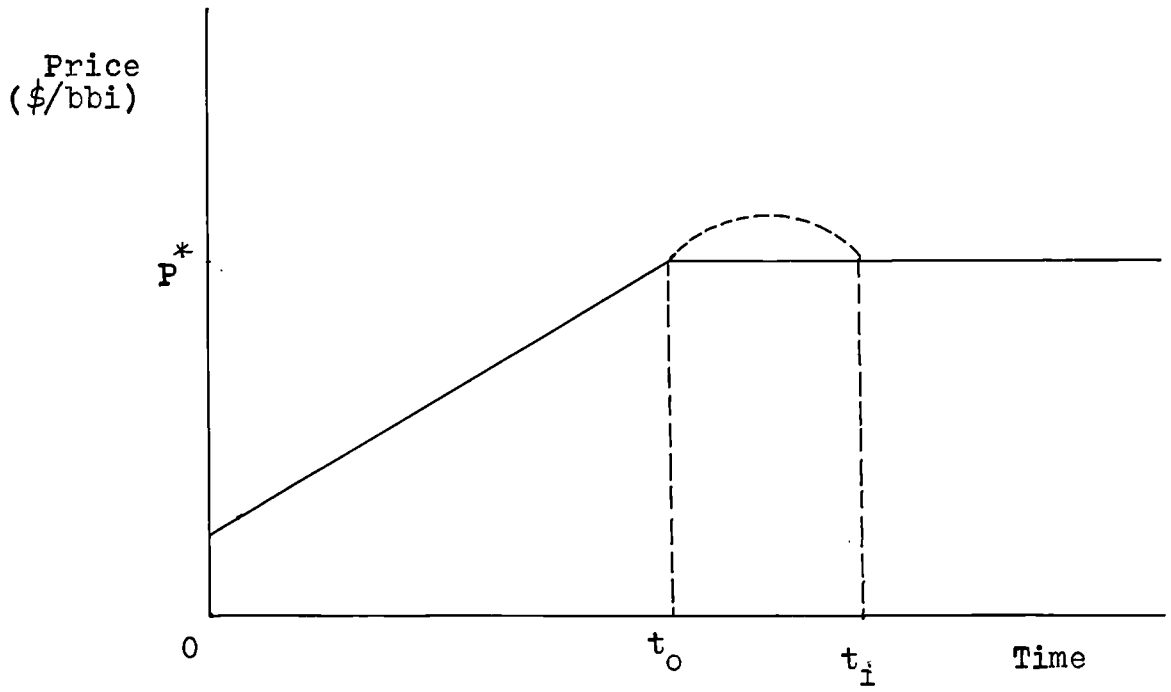


Figure 2.3 Oil prices with a backstop fuel.

overshoot.

(3)The scarcity of resources: Existing oil reserves may be a poor indicator to future user costs, since these are only the reserves found to date and surely future exploration will result in new finds. If the new discoveries matched expectations, producers will not need to revise their estimates of user costs so the oil price rises at the rate of interest. Suppose geologists sharply increased their estimate of the reserve base. The scarcity value of oil being thus reduced, user costs will be revised down sharply.

(4)Price elasticity of demand: Since demand conditions affect marginal revenues and thereby the user costs, the price path even in a competitive market depends on the price elasticity of demand. In the short run, the price elasticity for crude oil is generally known to be quite low. The magnitude of the long run elasticity is known with much less certainty since previous history provides little evidence for estimating consumer responses over current price ranges. The problem is exacerbated by the fact that a substantial adjustment period is required to alter the energy efficiency of the existing capital stock. However, the higher the price elasticity of demand the lower the user costs and price path.

The growth in oil demand resulting from world economic growth is another factor influencing the calculation of user costs. If producers expect rapid long run growth rates, user costs will be high.

4.1.3 Future uncertainty

User costs, like extraction costs, constitute a component of costs which in turn affect prices and the movement of prices over time. The intriguing aspects about user costs is that they are not directly observable, unlike a firm's labour or capital costs. Rather they depend on the producer's expectations about present and future supply/demand expectations.

On any one price path the producer requires explicit expectations regarding the discount rate, backstop fuel prices, resource base, and price elasticities of demand and the rate of economic growth. Changes in any one of these factors can cause substantial shifts in the price path. Moreover, changes in expectations regarding one of these factors are seldom made independently. For example, downward revisions of oil reserves, which means lower user costs and lower prices for oil, are frequently associated with a period of rapid economic growth, which places pressure on existing reserves and productive capacity. These effects may also be coupled with falling real interest rates. In effect, to the extent that revisions in one factor are correlated with reinforcing revisions in other expectations, price uncertainty is exacerbated.

Thus, oil producers are faced with price uncertainties, which in turn influence their revenues. This is not the only problem they have to face, as there is also a problem of distribution and substitution of oil revenues over time, especially in the Cartel Core Countries. This problem is the build up of an economic base to generate a continuous flow of income after the oil resource has depleted, and the distribution of revenues though consumption and investment for a number of generations. This latter point will be discussed in the next section, with particular attention to a statistical analysis of the behaviour of the OPEC-Core Countries.

2.2 The utilization of oil revenues:

The discovery of oil reserves in an economy is a form of windfall, and it inevitably raises the question of the uses of oil revenues and intergenerational equity. Obviously one option is that the generation discovering oil reserves consumes all revenues, leaving nothing for future generations. Although this is a purely theoretical conjecture, since no nation on earth would exploit a non-renewable resource in this manner, it

is partially happening. All OPEC Countries, to varying degrees, do allocate part of their oil revenues to subsidise current consumption using various means and methods. Oil production for current consumption, other than for investment, could be justified (in terms of profitability only) if investment of an extra $1 will produce a future consumption stream with the present value of $1, which implies of course that the producer's good purchased with this extra dollar also has the same value as a present consumption good sold for $1. Under these conditions society is indifferent as to whether it gets a little more consumption or a little more investment [Little and Mirrlees 1980 p.23].

The effect on the development of the economy of purely consuming the natural resource is apparent. This act, apart from the effects of immediate satisfaction, does not lead to economic development in the sense of creating a diversified economy. The absence of capital formation means that this non-renewable resource is being exhausted without actually being replaced by an economic base for the production of goods and services. This state of affairs would resemble the case of a man who sells his only house and consumes its value rather than substituting it with a productive asset to act as a source of continuing income. To take an extra example, imagine a country like Libya, producing oil and spending all the oil revenues on imported consumer goods, non-productive public works, and salaries of government employees. No part of the oil revenues is invested in productive projects which can act as alternative sources of income in the future. In this case, in the absence of any endeavour for economic development, the Libyan society will collapse to the state of a subsistence economy as soon as the oil resource base is depleted.

Absence of capital formation is not the only problem facing this policy. Lack of inter-generational equity is another problem. This policy would

allow the consuming generation to enjoy the total utility of this consumption while in the meantime denying it to other generations. Social welfare can be judged to be a function not only of utilities of the individuals who are members of society at present, but the utilities of all future members of society as well [Pigou 1948 p.29].

Hence, the strict allocation of oil revenues for current consumption does not help the process of economic development, and ignores the rights of future generations to consume part of it. OPEC-Core countries (the nations most dependent on oil revenues) are the sole owners of their oil resources. They are fully responsible for the design of their oil production policies and for the disposition of their oil revenues. They are expected, therefore, to avoid wasteful use of this resource, and to minimize the amount of oil revenues allocated for that current consumption which is socially uneconomical.

One way of taking into account the interests of future generations is to consider Rawls' rules of a just society [Rawls 1972], especially his max-min criterion. He suggests that we can gain insights into the nature of justice by envisaging individuals behind a 'veil of ignorance' drawing up an agreed contract or set of rules for the operation of a just society. Since individuals can not know the characteristics of the state into which they will be born, or personal characteristics such as colour, sex, intelligence and so forth, they will have no incentive to make choices in favour of narrow personal interests (since they will not know what they are). Personal interests can be pursued only by agreeing to just rules for the conduct of society. One of the important rules which Rawls asserts would be adopted is the max-min criterion for assessing the justice of inequality. He argues that inequality in the distribution of wealth or utility is justified only if it is a necessary condition for improvement in

the position of the poorest individual or individuals.

Given various states of nature and various courses of action that could be taken, the max-min principle dictates that we should first observe all the minimum pay-offs and then select the highest of these. To use the maximin principle we circle the minimum pay-offs from each course of action. Then we select the highest minimum pay-off. This is 4 and entails that we would select course of action 3.

Course of action \ State of nature	1	2	3	4
1	(2)	5	(2)	5
2	1	2	1	(0)
3	5	(4)	6	5
4	1	(0)	4	7

In other words, if social welfare, W, is to be written as a function of utilities $U_1, \ldots, U_n$, then Rawls argues for the particular function $W = \min(U_1, \ldots, U_n)$, so that maximizing social welfare amounts to maximizing the smallest U_i. This welfare function is sensitive only to gains and losses of utility by the poorest person. It should be clear that we hold to the standard assumption that at each instant of time consumption is shared equally by the population of the moment. The only equity problem that arises is that between instants of time (i.e "generations").

According to this criterion, Solow argues [Solow 1974] that if consumption per head were higher for a later than for an earlier generation, then social welfare would be increased if the early generation

were to save and invest less, or to consume capital, so as to increase its own consumption at the expense of the later generation. If consumption per head were higher for an earlier than for a later generation, then social welfare would be increased if the early generation were to consume less and, correspondingly, save and invest more, so as to permit higher consumption in the future. Thus the max-min principle tells us that consumption per head should be the same for all generations.

Suppose population is constant and there is no technical progress, then the max-min criterion implies constant consumption per head and keeping the value of oil reserves constant. If P is the price per unit of the resource and R the total reserves, then the criterion calls for a consumption of $C_0 = rP_0R_0$, where r is the rate of interest. Thus one option is to draw enough oil from the ground so as to maintain that level of consumption.

If the price of oil rises at the rate of discount, then

$$P_t = P_0e^{rt} ,$$

and $R_t = R_0e^{-rt}$

Then $P_tR_t = P_0e^{rt}R_0e^{-rt}$

$$= P_0R_0$$

This is a feasible strategy for a marginal producer where he can keep a constant level of consumption over time at lower rate of depletion. This case is shown graphically in Figure 2.4 below.

Now suppose population N is growing at a rate n, then consumption per head (c) is:

$$c_0 = C_0/N_0 = (r-n)P_0R_0$$

Now $R_t = R_0e^{-(r-n)t}$

$$P_t = P_0e^{rt}$$

$$N_t = N_0e^{nt}$$

So $c_t = (n-r)R_tP_t/N_t = (n-r)R_0e^{-(r-n)t}P_0e^{rt}/N_0e^{nt}$

Figure 2.4

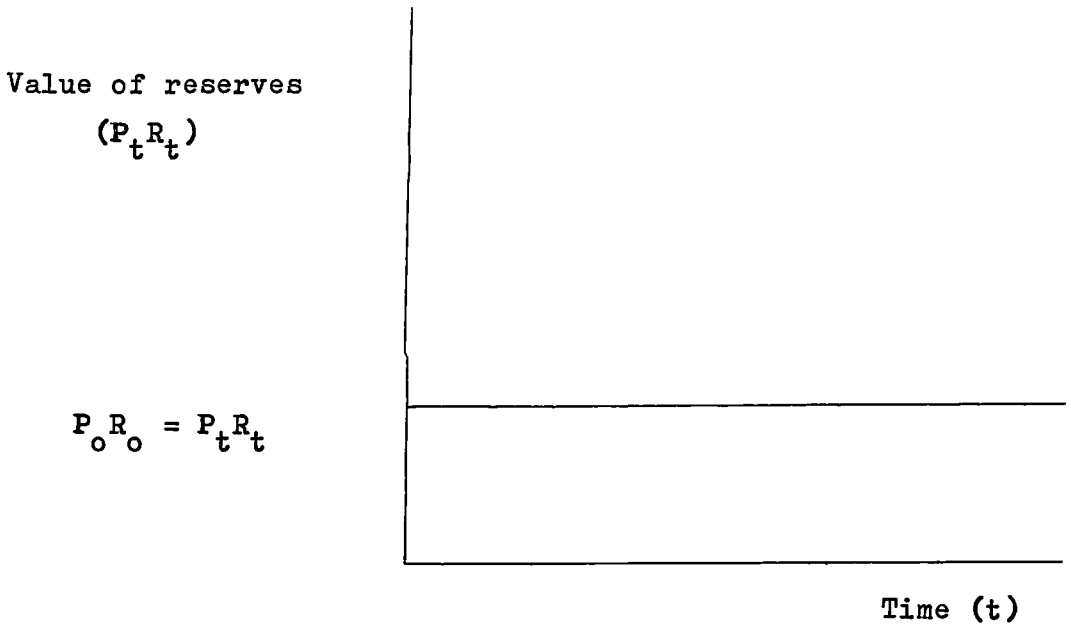
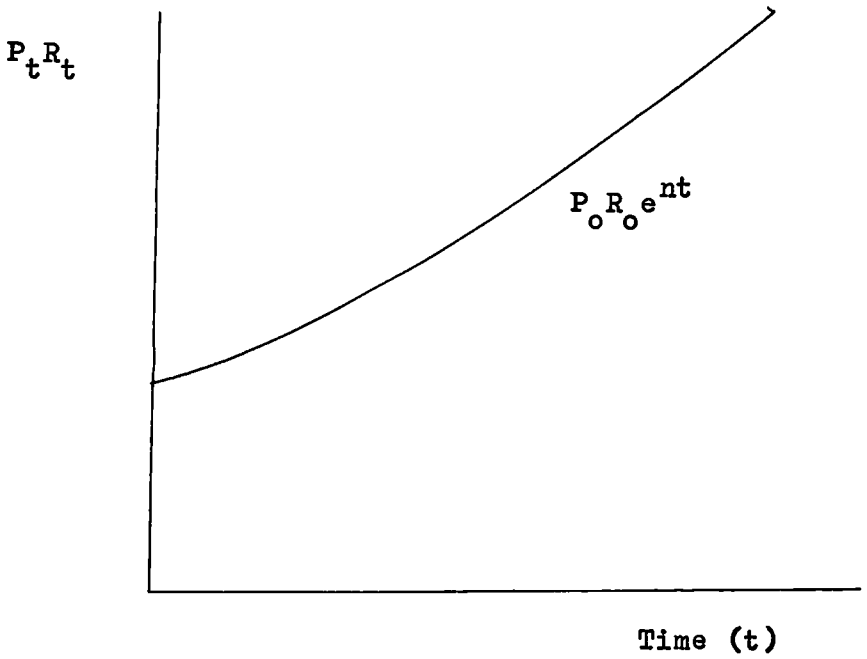


Figure 2.5



$$=(n-r)R_0P_0/N_0$$

$$\text{and } P_tR_t = R_0e^{-(r-n)t}P_0e^{rt}$$

$$P_tR_t = P_0R_0e^{nt}$$

Even though the value of reserves increases in effect to the increase in population, as shown in Figure 2.5, consumption per head is decreasing. Here the max-min rule, as Solow [1974 p.32] put it, says: "the initial generation should invest only enough to provide capital for the increase in population, over time, at the initial capital-labour ratio".

However, an economy can do better than that. Leaving oil in the ground is a form of investment. This policy alternative entails deferring production until some future time, which I previously expressed as $P_{t+1} > P_t(1+r)$. This kind of postponement is one way of accomplishing physical conservation, and scarcely happens in practice in its pure form.

That the act of physical conservation of the oil resource, or for that matter any natural resource, is unjust to current generations is very clear. This policy simply means depriving those generations of the benefits that might accrue to them as a result of exploiting the oil resource. However, since physical conservation involves abstention from production now, and exploitation by future generations, it is difficult to conceive how this policy is also not entirely favourable to future generations. It is true that the oil resource is being entirely shifted, in this instance for the disposition of future generations. This leads to increasing the utility of future generations at the expense of current generations. The desirability of leaving oil in the ground should be judged in relation to the rate of return on alternative investment projects. Moreover, the advantage of investments other than keeping oil in the ground is that it benefits all varieties of technical progress. Here the following considerations are relevant:

(a) Technical change, in particular those which augment energy resources, would adversely affect the price of oil, thus the rate of return from leaving oil in the ground may well be less than what it would be in the absence of technical change. Moreover, a technical change which reduces the value of oil would also increase the rate of return on reproducible capital goods.

(b) Leaving aside the considerations of economic development, the uncertainty about the future course of oil prices calls for a diversification of investment. In general, the alternatives to keeping oil in the ground are: (1) foreign financial investment, and (2) domestic investment.

(1) Foreign financial investment:

Even though financial surplus is subject to erosion in real terms, through the depredations of inflation and the depreciating dollar, investment abroad offers another option for diversified investment and probably high rates of return. Moreover, domestic consumption and investment policies may suit a large Core Country like Saudi Arabia. This kind of policy may not be appropriate for smaller states with small populations, such as Kuwait or Qatar. In this case it might be wise to invest oil revenues abroad as long as its profitability is higher than the expected rate of interest. The fact that the Core Countries continue to produce oil at rates far above what is necessary to meet their financial requirements is a function of their concern for the world economy rather than their own individual interests. It shows a recognition that they cannot develop properly except within the context of a healthy world economy, but that does not make the financial sacrifice any less unpalatable to public opinion in the countries concerned.

Another perhaps even more important lesson learned by the oil producers

is that the pace of development should not be accelerated beyond the capacity of the country to absorb it in a fruitful way, whether economically, politically or socially. The oil producers, particularly the Cartel Core Countries, are coming to feel that their developmental transformation should proceed at a more measured pace, and cannot possibly be completed in the span of a few five-year plans.

Besides, physical or financial assets in the hands of a host country abroad are always subject to the risks of nationalisation, expropriation, freezing, or depreciation [the freezing of Iranian assets in the U.S.A., at the time of American Empassy crises in Iran, served as a vivid example of the vulnerability of these investments]. On the other hand, for a private investor who is not concerned with economic development, non-pecuniary benefits are immaterial to him and he is always willing to invest abroad if the rate of return is worth the risk. But it must be mentioned here that I do not consider as "investment abroad" any investment carried out within a single family of countries which are seeking economic integration and eventually unity, such as investment in the Arab Countries. However, besides the accruing pecuniary benefits, domestic investment yields significant non-pecuniary benefits in the form of external economies, while investment abroad yields pecuniary benefits only.

(2) Oil production and domestic investment of oil revenues:

Now production for immediate satisfaction by consumption does not provide any future satisfaction to future generations, and complete physical conservation ignores the welfare of the present generation. An alternative policy (bearing in mind the problems of investment abroad) is domestic investment which transforms the natural resource into physical and human capital for the benefit of present and future generations. For this reason I will assume at this stage that domestic investment needs provide the

Cartel-Core Countries with the least production level (floor production). This will vary with the price level. If the investment requirement is I_t and the price level P_t, floor production is defined by $\bar{q} = I_t/P_t$.

The production at the level of domestic investment (as a lower bound), together with the maximum attainable capacity (as a higher bound) constitute the limits of which OPEC-Core and OPEC as a whole can be stabilised.

Governments can reduce aggregate private consumption, and thus increase savings, by taxation. On the other hand, taxation has administrative and political costs, so perhaps it is money in the hands of the government which should be considered to be more valuable than private consumption. This view is strengthened by the fact that a rational government should see that the value of its expenditure at the margin is equal in all lines, whether it be defence, agricultural extension, education, or investing in industry.

The most socially acceptable policy in Core Countries, as defined in Chapter 1 (Saudi Arabia, the UAE, Kuwait, Libya and Qatar), is to produce oil at the maximum absorption capacity level. I will argue in Chapter 3 that some economists such as David Teece adopted this view to formulate their models of OPEC behaviour. Oil production and investment of oil revenues should serve as a basis for formulating government policies concerning the utilization of oil in OPEC Countries. The reason is that this policy serves best the interests of present and future generations on the one hand, and acts as the prime initiator of economic development in these countries on the other [Zainy 1981 p.56].

To illustrate the connection between oil production and absorptive capacity in a Core Country, let us examine Figure 2.6. First, Figure 2.6-(a) shows a graphical relationship between aggregate investment (I) in

one year and the corresponding social rate of return on investment (r) in that year. The period of one year is taken arbitrarily. The social rate of return is a function of many variables such as investment level (I), labour supply (L), technology (T), management (M), etc. In functional notation: $r = f(I, L, T, M, \ldots)$. As the investment level is raised, putting further strain on the other input variables which are assumed to be fixed during this period of time, the rate of return after a certain investment level starts declining. This is in effect the law of diminishing returns or variable proportion. The graphical relationship between r and I is a curve with a negative slope indicating declining rate of return with higher investment. Each additional amount of investment has a corresponding rate of return. If the socially acceptable rate of return is r_1, then the allowable level of investment in that year is I_1. Any further investment beyond I_1 will be socially unprofitable. However, if the socially acceptable rate of return is lowered to r_2, the level of investment that can be absorbed profitably in that year will increase to I_2.

Figure 2.6-(b) shows the level of aggregate investment in a particular year and the amount of oil production Q in this year required to finance this investment. The curve is a straight line passing through the origin assuming fixed oil prices during the year (this assumption is only to simplify the presentation of the argument), and that oil is produced only to finance investment. If investment levels I_1 and I_2 from Figure 2.6-(a) are projected on Figure 2.6-(b), the corresponding required amount Q_1 and Q_2 of oil production can be determined.

If an OPEC-Core Country can market as much oil as it can produce, the proposed scenario of oil production as constrained by investment requirements will be the following. Suppose the socially acceptable rate

Figure 2.6-a Aggregate investment versus social rate of return

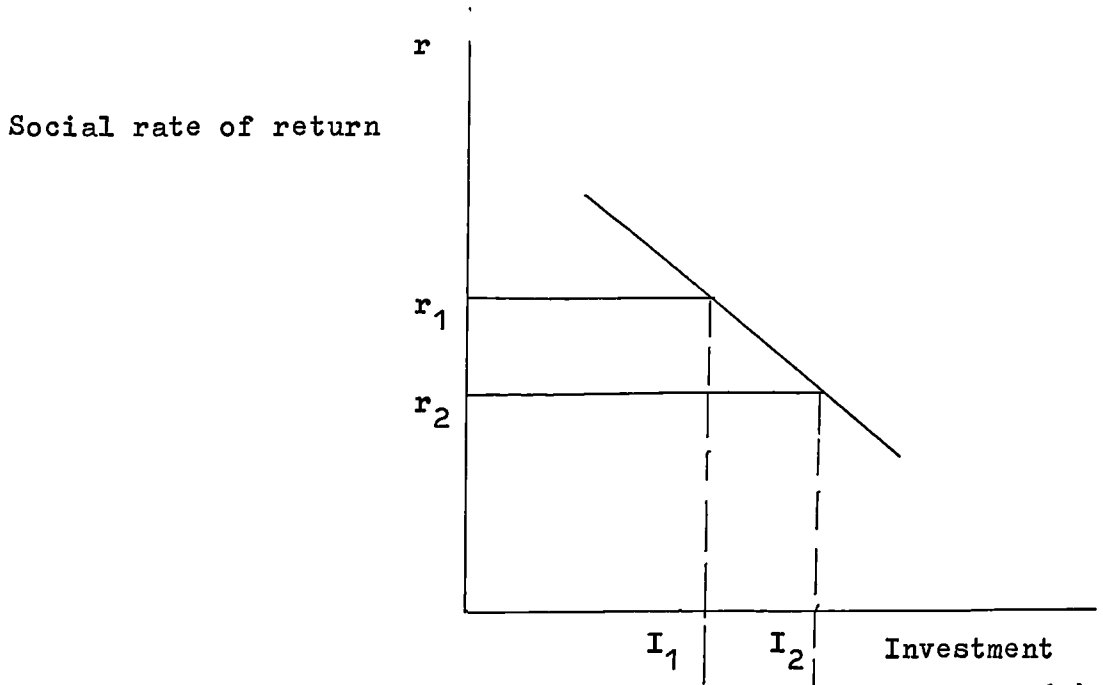
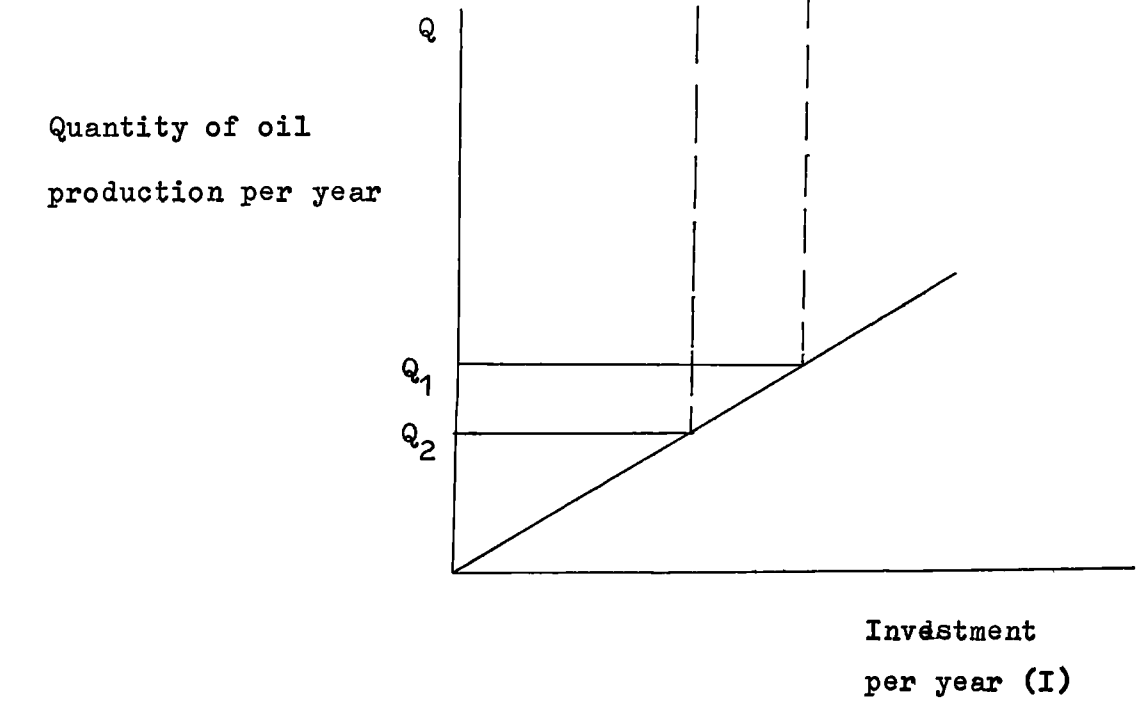


Figure 2.6-b Aggregate investment and the corresponding oil production



of return is r_1 as in Figure 2.6-(a). Any investment more than I_1 will entail a social loss corresponding to what additional costs might have been avoided by the Country had the amount of investment been I_1 and not more. The optimum amount of investment which maximizes the social benefits of the Country is I_1. Thus there is a maximum capacity of the Country to absorb investment capital, commensurate with a specified acceptable social rate of return. The corresponding optimum oil production rate will be Q_2.

It is assumed above that domestic investment needs provides the OPEC-Core Countries with the least production level (floor production). The next section provides a statistical analysis to this assumption in relation to oil revenues. It will also be revealed that neither consumption nor investment determine the level of oil revenues. The problem is far more complicated than these simple assumptions.

An empirical analysis of OPEC-Core domestic investment and oil revenues

Oil revenues in OPEC-Core Countries increased substantially during the 1970s. This increase in oil revenues increased both consumption and investment (domestic and foreign). Table 2.1 shows that the annual rate of growth of domestic investment in the Core Countries were increasing steadily, at first, until it reached the peak of 68.83% in 1975, then it continued to rise but at a lower rate than the experienced hitherto.

Table 2.1

Oil Revenues Versus Domestic Investment

in OPEC-Core Countries in $M(1971-1982)

Year	Oil Revenues[1]	R*	Domestic Investment[2]	R*	I/R Ratio
1971	5144		2209		0.43
1972	6518	26.71	3138	42.06	0.48
1973	9661	48.22	5121	63.19	0.53
1974	42501	339.92	8392	63.87	0.20
1975	44855	5.54	14168	68.83	0.32
1976	54217	20.87	20849	47.16	0.38
1977	63928	17.91	29309	40.58	0.46
1978	58734	-8.12	36920	25.97	0.63
1979	105552	79.71	40422	9.49	0.38
1980	167007	58.22	50553	25.06	0.30
1981	167122	0.07	61503	21.66	0.37
1982	118622	-29.02	68269	11.00	0.58

(*) Annual rate of growth.

Sources:

(1) OPEC Annual Statistical Bulletin. 1982, Table 30 p.30.

(2) Arab Monetary Fund [1983].

Table 2.1 also shows that Domestic Investment/Revenue (I/R) Ratio was increasing steadily until the first oil shock in 1973-74, when this ratio suddenly dropped from 53% in 1973 to 20% in 1974. In 1978 the I/R ratio dropped again from 63% to 38% in 1979, and 30% in 1980 due to the effects of the second oil shock of 1979-80. Once more the I/R ratio increased in 1981 and 1982 because of the decline in oil prices coupled with the reduction in output due to the recession of early 1980s. Oil revenues

declined while domestic investment carried on its steady increase. This is shown in Figure 2.7 for each OPEC-Core membeer. As a result the I/R ratio increased from 30% in 1980 to 58% in 1982.

Since according to the assumption that domestic investment constitutes the minimum required production for the Core Countries, then the Core financial difficulties would not occur till domestic investment plus some acceptable level for current consumption exceeds oil revenues. In other words [I/R $\geq$ 1].

Empirically, throughout the period (1971-1982) OPEC-Core stability has never been threatened, simply because the I/R ratio has never reached unity. The highest I/R ratio of 63% in 1978 was far away from unity. The best time for OPEC, when it was really strong, was in 1974 where (I/R) was 20%.

However, the rise in prices has had a direct effect on oil revenues causing a reduction in the domestic investment/revenues I/R ratio, which suggests a high level of stability. Conversely, the first half of the 1980s showed that both oil prices and output for OPEC-Core producers have been reduced. This resulted in substantial reductions in oil revenues and probably a high I/R ratio.

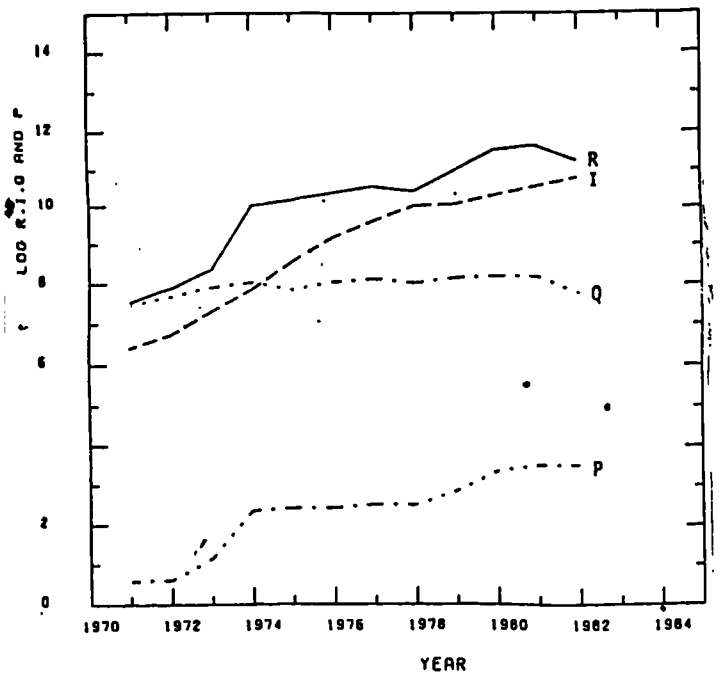
Oil revenues R_t at any time is equal to P_tQ_t , and the change in oil revenues is given by:

$$dR_t = P_t dQ_t + Q_t dP_t$$

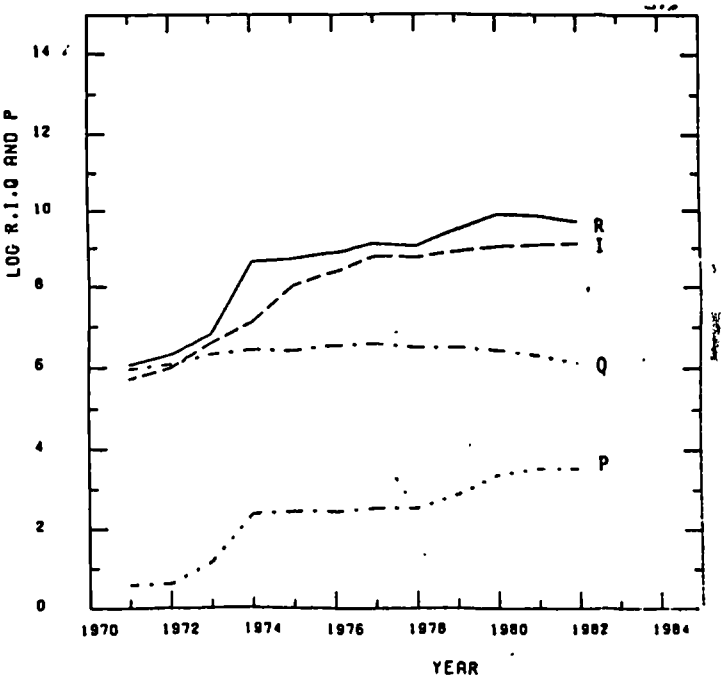
Where $P_t dQ_t$ is the effect of the change in oil production on the change in oil revenues, and $Q_t dP_t$ is the effect of the change in oil prices on the change in oil revenues. This can be approximated by:

Fig. 2.7 OPEC-CORE Crude Oil Data

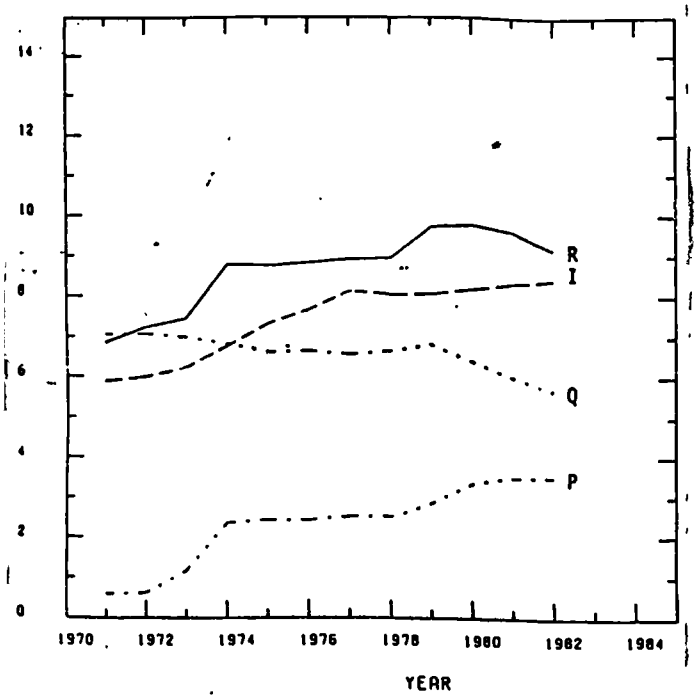
Saudi Arabia



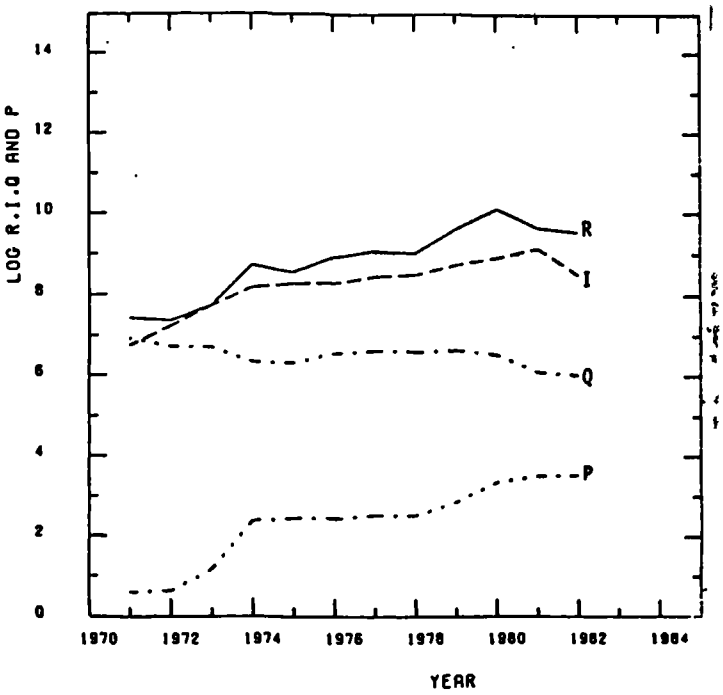
The UAE



Kuwait



Libya



$$\Delta R_t = \overline{P}\,\Delta Q_t + \overline{Q}\,\Delta P_t$$

$$\overline{P}_t = (P_{t+1} + P_t)/2 \text{ and } \Delta P_t = P_{t+1} - P_t$$

$$\overline{Q}_t = (Q_{t+1} + Q_t)/2 \text{ and } \Delta Q_t = Q_{t+1} - Q_t$$

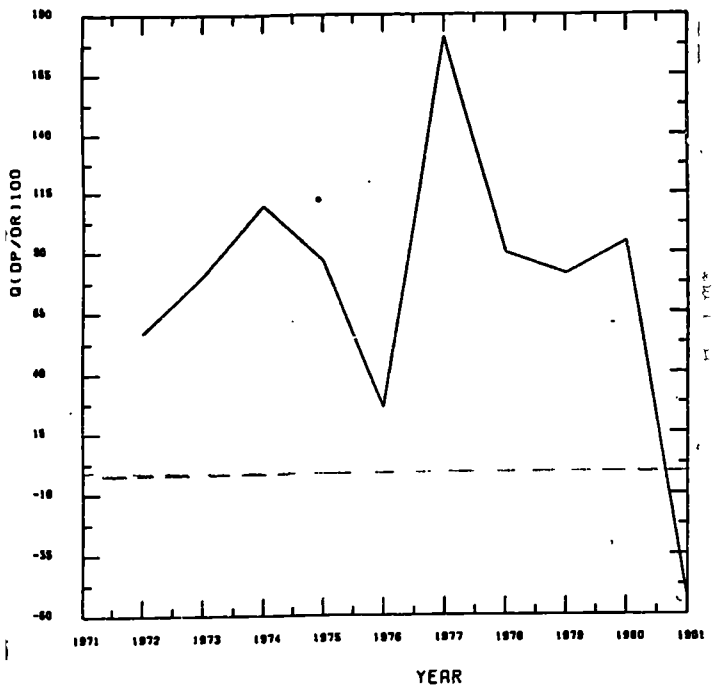
Then, the above equation takes the following form;

$$\Delta R_t = (P_{t+1} + P_t)/2\ (Q_{t+1} - Q_t) + (Q_{t+1} + Q_t)/2\ (P_{t+1} - P_t)$$

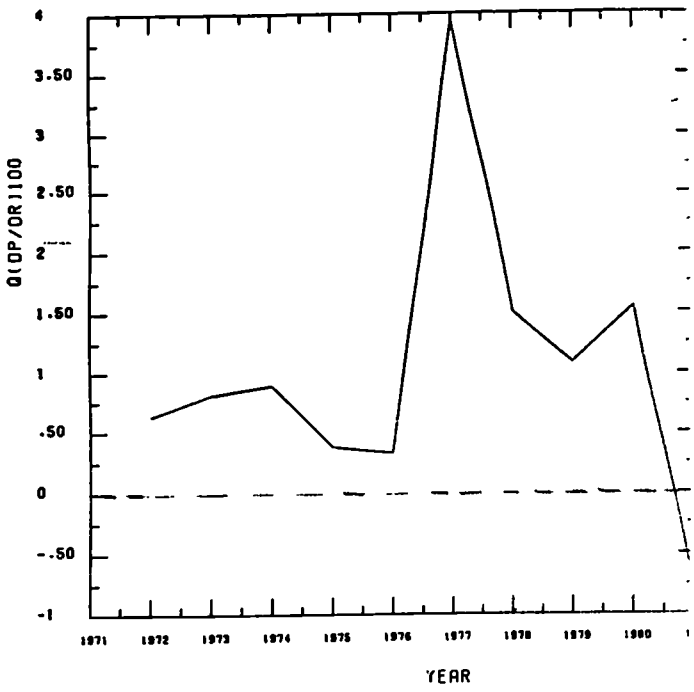
The results of applying the above equation are shown as percentages of ΔR_t in Figure 2.8. The Figure shows that during both price shocks of 1973-74 and 1979-80, OPEC-Core revenues were affected by the increase in crude oil prices, but the extent of these effects varies from one country to another. The Gulf States generally followed a similar pattern. They increased their production (except Qatar) after the 1973-74 price rises in an attempt to prevent further price increases and thus stabilise the oil market. Henceforth they reduced their production in turn. First, Kuwait in 1976 and then Saudi Arabia, Qatar and the UAE in 1977. Once more Saudi Arabia in 1979 and 1980 increased its production to compensate for the loss of Iranian oil. On the other hand, Libya reduced its production level throughout the 1973-75 period. This behaviour increased the price effect on the increase in its oil revenues as shown in the Figure. The $Q\Delta P/\Delta R$ for Libya was the highest in the Core Countries 260% in 1974, while in the same year it was 217% for Kuwait, 157% for Qatar and 109% for Saudi Arabia. For the following four years (1975-78), Libya (contrary of the Gulf States) increased its production steadily reducing the price effect on oil revenues. By 1981 neither oil prices nor OPEC-Core production increased, and hence neither did oil revenues. This is clear from the negativity of the change in oil revenues in Libya and Kuwait in 1980, and the negativity of this change in revenues in all OPEC-Core Countries in 1981. The $Q\Delta P/\Delta R$ ratio ranged from -20% for Kuwait to -80% for the UAE. This result confirms that the decline in oil prices had a great effect on reducing the

Figure 2.8 Q(ΔP/ΔR) as percentage

Saudi Arabia

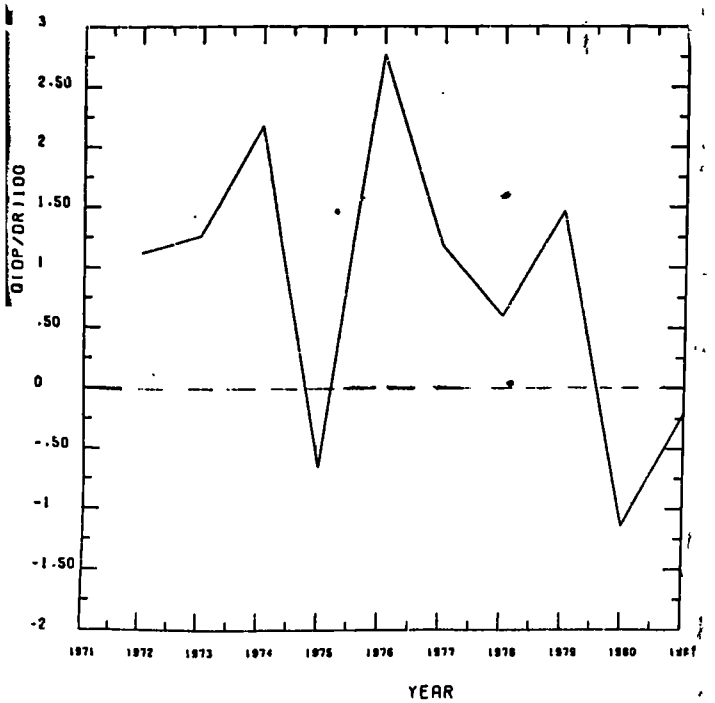


The UAE



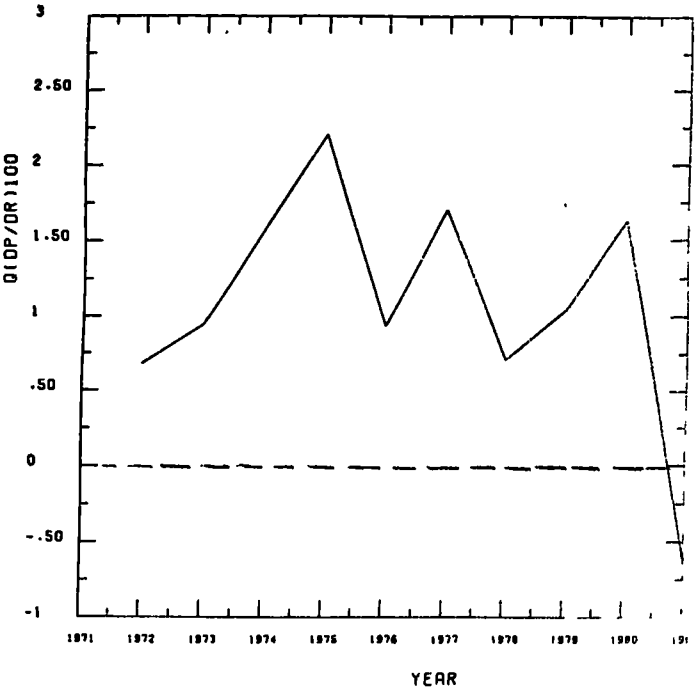
XAXIS:SCALE AS PRINTED.
YAXIS:SCALE = Y * (10 **-2)

Kuwait



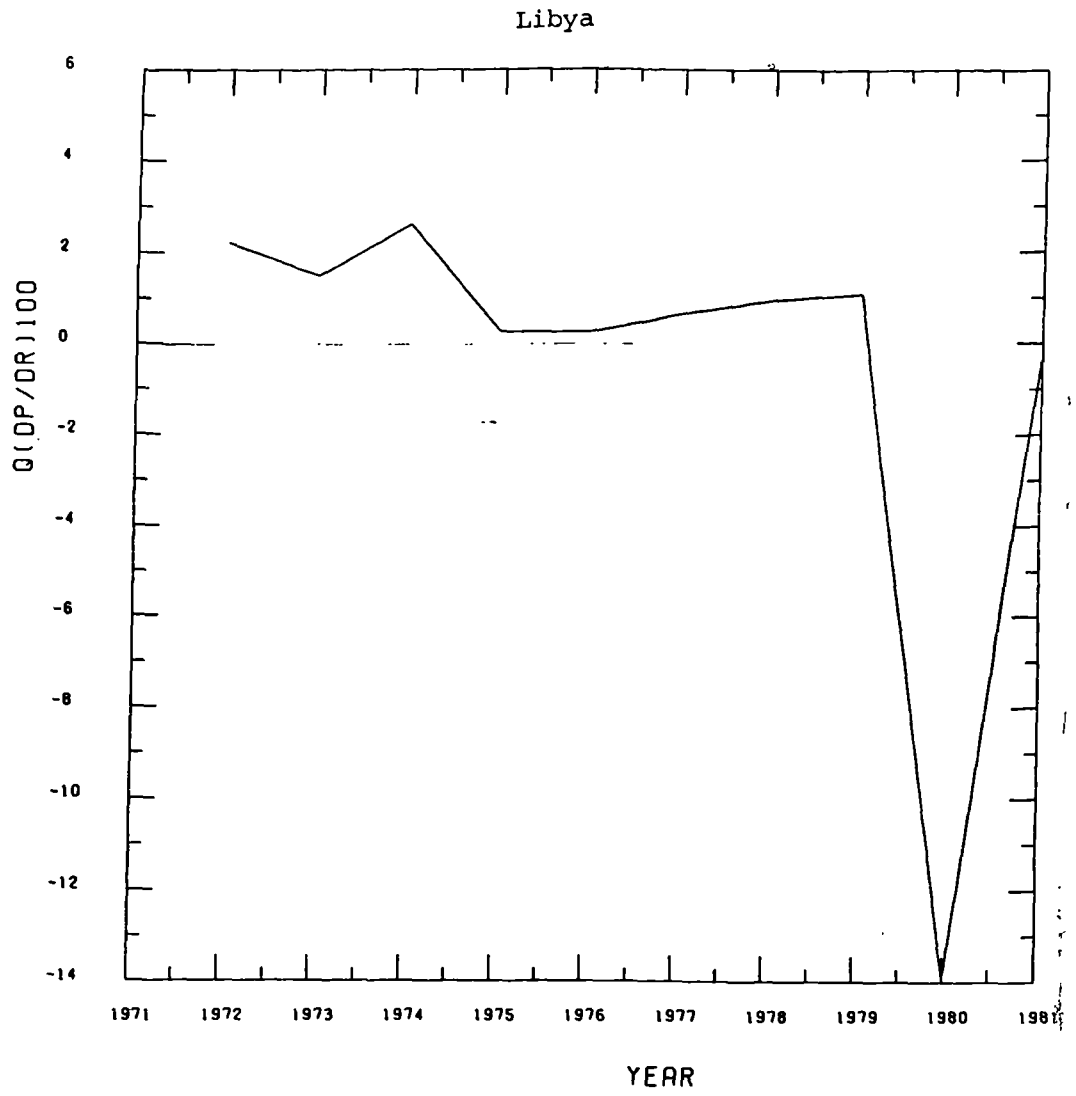
XAXIS:SCALE AS PRINTED.
YAXIS:SCALE = Y * (10 **-2)

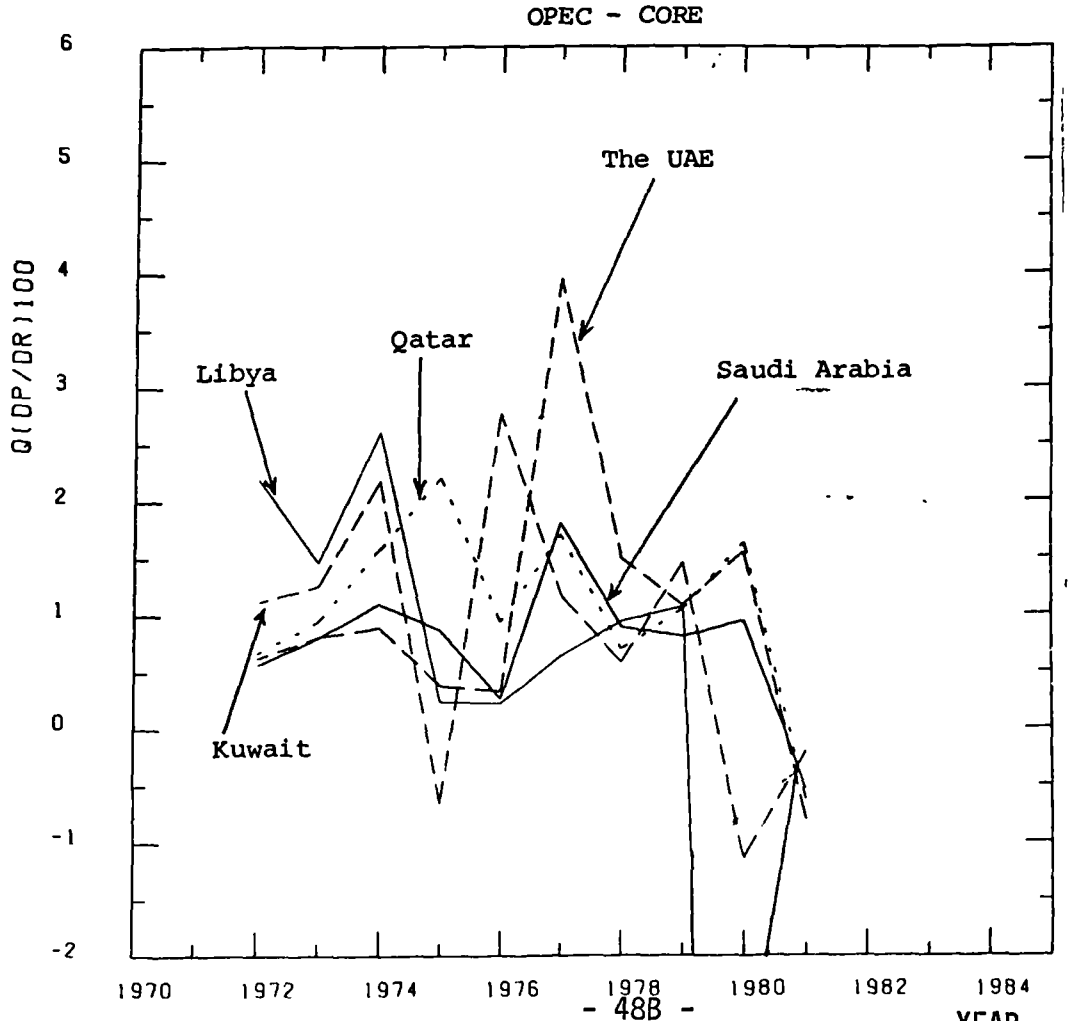
Qatar



XAXIS SCALE AS PRINTED
YAXIS.SCALE = Y * (10 ** 2)

Figure 2.8 Q(ΔP/ΔR) as percentage





OPEC-Core oil revenues. This effect was smaller in Kuwait and Libya than the rest of the Core Countries, because these two countries reduced their production by a proportionally greater amount than the others during 1979-1981.

The above analysis indicates that even the OPEC-Core Countries, which are theoretically expected to behave collectively, in reality behave differently. This is one case where cartelisation theory cannot provide a satisfactory explanation. Other cases concerning the paradoxical behaviour of oil producers will be discussed in the next Chapter.

Furthermore, considering the option of producing oil at the level of domestic investment only is also unrealistic. This policy assumes that OPEC-Core Governments draw a target for investment and a target for consumption. In other words they have a clear target of the form;

$$I_t^T + C_t^T = A\, e^{\beta t}$$

But actual oil revenues are $R_t = P_t Q_t$

If OPEC-Core Countries are actually producing oil according to the revenue target then;

$$P_t Q_t = A\, e^{\beta t}$$

$$\text{or } \log Q_t = \log A - \log P_t + \beta t$$

By regressing this model for each OPEC-Core Country I obtained the following results:

(t-values in parentheses).

1- Saudi Arabia $\log q_t = 7.5649 + 0.2509 \log P_t - 0.0298\ t$

$R^2 = 0.5228$ (1.7171) (0.7138)

2- The UAE $\log q_t = 6.0476 + 0.3025 \log P_t - 0.0626\ t$

$R^2 = 0.4077$ (2.1052) (1.5237)

3- Qatar $\log q_t = 5.2095 + 0.0723 \log P_t - 0.0383\ t$

$R^2 = 0.2719$ (0.6414) (1.1903)

4- Kuwait $\log q_t = 7.3080 - 0.0499 \log P_t - 0.0876\ t$

$R^2 = 0.7683$ (0.2637) (1.6192)

5- Libya $\log q_t = 6.9662 - 0.2782 \log P_t + 0.0271\ t$

$R^2 = 0.5711$ (1.7186) (0.5867)

6- OPEC-Core $\log Q_t = 8.4884 + 0.0981 \log P_t - 0.0273\ t$

$R^2 = 0.0642$ (0.7820) (0.7612)

(10 observations, 1972 to 1981).

The above results show that at the 5% level P_t and t are not significant explanatory variables. Further, the coefficients of log P_t are all significantly different from unity, the value suggested by the model. Also, apart from Libya, the coefficient of the time trend has the opposite sign to that in the model. Considering the target equation above, these results mean that the target revenue cannot be said to depend on target investment plus target consumption. This is because of the OPEC internal problems and the problems of the oil producing community at large, as will be discussed in the next chapter.

CHAPTER 3: MODELLING OPEC BEHAVIOUR

In the previous Chapter I showed the importance of exhaustible resource theory in predicting the price paths for a depletable resource, under both monopoly and competition. This theory was applied to the oil industry by modeling OPEC Behaviour where the initial price is given exogenously. Unfortunately most of these studies were done for the period 1974-1975 where OPEC acted as a real cartel. The model's predictions were therefore as suggested by Hotelling for monopoly price behaviour. Because of the assumption of cartelisation, the models which will be discussed below cannot provide a precise explanation of OPEC behaviour. This is because the cartel members are only interested in profits, but none of them is willing to sacrifice, by reducing production, to prevent a drop in prices and consequently the cartel must collapse.

This thesis departs from the usual way of modeling OPEC behaviour, as stated above, and instead it provides an alternative explanation of OPEC behaviour through the application of Game Theory, where the individual country interests may coincide with or be opposed to the interests of the others in the group. This sort of game suggests a possibility of sacrifice by a number of producers to prevent mutual disaster. This, certainly, is not acceptable to a monopolist, whose main function is pure profits.

Accordingly, this Chapter has two main aims. First, to review selected OPEC behaviour models. Since my purpose is the assessment of OPEC behaviour, I provide a relatively longer discussion for the cartelisation models. Some of the other political, property rights and development needs explanations will also be reviewed. Second, I discuss game theory concepts, with more concentration on non zero-sum games, where the notion of mutual interdependence of the players provides a concrete ground for the

application of the theory to OPEC members. Fortunately, the Hnyilicza and Pindyck [1976] model of Section One, provides a useful argument on the cooperative side, of which I make use in a more comprehensive cooperative and non-cooperative assessment.

3.1 Models of OPEC and the world oil market:

Several important attempts to model and evaluate the prospects for OPEC, and the likely future path of world oil prices, are surveyed and critically reviewed. The first group of models were either simulation models or optimization models. The other group of models were concerned with OPEC being (1) a unified cartel, (2) behaving in a way to satisfy its domestic requirements, (3) politically motivated. There is one model (Hnyilicza and Pindyck, 1976), which departed from the usual approach in viewing OPEC behaviour. This model introduced game theory, with Nash Cooperative Solutions being used to explain the likely outcome of future OPEC behaviour.

The models surveyed are, to a great extent, influenced by the evolution of oil prices in the 1970s, where the sharp rise in prices suggested that there was no other explanation of oil markets other than OPEC cartelisation. Further, as we saw earlier in Chapter Two on the economics of exhaustible resources, rising prices for an exhaustible resource is quite compatible with perfect competition. This view cannot be taken for granted, especially in the 1980s, where some OPEC members have shown an intention to violate the collective agreements to satisfy their individual interests. On the other hand there were signs of cooperation and readiness for sacrifice by other members. In my assessment of OPEC behaviour, which will be explained later on in the present Chapter, I attempt to introduce the non-cooperative solutions as well as the cooperative ones. This is because, although we might expect the parties to cooperate, we must

recognise the possibility , for one reason or another, for them not to cooperate. The idea of threat is particularly useful in this assessment, because the threatener (usually) thinks the threat is successful. But the threat's efficacy depends on the credulity of the other party, and the threat is ineffectual unless the threatener can rearrange or display his own incentives so as to demonstrate that he would, ex post, have an incentive to carry it out.

The models of OPEC behaviour briefly discussed, before the presentation of our own explanation, are: Blitzer-Meeraus-Stoutjesdijk (B-M-S) [1975], Bohi- Russell(B-R) [1975], the U.S. Federal Energy Administration (FEA) [1974], Kennedy[1974], Kalymon [1975], Levy[1974], Nordhaus [1973], Adelman [1981], Johany [1978], Teece [1981], Moran [1981] and Hnyilicza and Pindyck [1976]. Particular attention will be given to the Hnyilicza and Pindyck model, because of its relevance to the explanation of OPEC behaviour through the use of game theory, which is the focus of our interest. First, I shall discuss the basic approaches to the problem, identify their principal contributions and conclusions and discuss their main shortcomings. Second, I present an explanation of OPEC behaviour through Game Theory, showing the coexistence of the cooperative and non-cooperative behaviour of OPEC members of which accordingly, the likely outcome can be determined. Third, building upon the latter point, I attempt to analyse the oil market as a whole. OPEC and non-OPEC producers (the competitive fringe) will be reviewed by scrutinising cooperative and non-cooperative solutions.

Although the specific details of the models differ considerably, it seems fair to say that two basic approaches have been used to analyse OPEC behaviour:

1-Simulation models: In most simulation studies, excepting the model of Hnyilicza and Pindyck, the basic technique is the same: given the basic model, and assuming values for the various parameters (price elasticities of demand and non-OPEC supply, demand growth rates, and the like), a variety of possible price-path strategies are postulated, and the implications evaluated over the time horizon. Of the price paths considered, one or more are selected, according to some prespecified criterion, as the best or as most likely. In the B-M-S model, for example, several criterion functions were examined but the ranking of policies was not especially sensitive to the function utilized. Among those considered were the following two: (1) the present value of the net revenue stream obtained from oil sales over the planning period, plus the present value of oil still left in the ground at the end of the planning period; and (2) the present value of net foreign asset holdings in each period, plus the present value of the oil left in the ground at the end of the planning period.

In the comparative static simulation models (FEA, Kennedy, Levy), the basic question asked is: if OPEC sets its price at a certain level, then maintains that price through the year (T), what are the implications for its output level and profits in that year? In this case, the focus is upon the new (static) equilibrium that would result from any maintained price after sufficient time has elapsed for demand and non-OPEC supply to adjust fully to the new price. Not explicitly considered in these analyses are the dynamics of the system or the characteristics of the transition period before the new equilibrium is reached. The essential feature of all these analyses is that they consider only constant-price paths over the time horizon of the model.

Dynamic simulation models (B-M-S and Kalymon), on the other hand, trace

the year-to-year movements towards an equilibrium, rather than just the final equilibrium position. Furthermore, they consider the implications of non-constant price-path strategies, tracing the effects of changing the price again (and again) before the equilibrium adjustments to the initial price change have had time to work themselves out.

2-Optimization models: Unlike the simulation models, in which a finite number of prespecified price paths are investigated, the optimization models (in principle, at least) evaluate all of the infinite variety of price paths possible. By specifying some criterion function, then deriving the characteristics of the price-output path that maximizes this function, the optimizing models seek to identify the best of all possible trajectories. Of course, in general the computation of the optimal price trajectory can be fairly complex; thus in examining the actual price paths only a few relatively simple specifications of demand and supply have been employed, thereby limiting the generality of the conclusions on optimal price paths to only those functional forms.

In specifying an optimizing model, three approaches have been used. First, Kalymon has specified a criterion function (the present value of the total net profit stream) which must be satisfied by export and domestic prices, which automatically yields a numerical objective to be maximized. Second, B-R identify the principal variables that would enter the utility function, then make a judgemental decision as to how these variables will, on balance, affect the country's preferences regarding prices and output levels. Third, Hnyilicza and Pindyck used the Nash Cooperative Solution to analyse the relative gains to saver and spender countries of OPEC.

3.1.1 The models:

A- Kennedy, Levy, FEA. In terms of the classification scheme outlined above, Kennedy, Levy, and the FEA report fall under the heading of comparative static simulation analyses. In all three studies, the basic question being asked is whether or not OPEC could sustain the then current price of oil through 1980 or 1985; if not, the question is what price is sustainable. However, one may ask whether or not the price-output combination chosen by OPEC countries is consistent with the underlying demand function. Both Kennedy and Levy assume from the start that any production cutbacks will have to be shared by only some, not all, members of OPEC. They thus consider only the price sustainable by these sub-groups.

Kennedy [1974] concludes that in the base case (with non-OPEC supply elasticity of 0.33 and unitary income elasticity of demand) 1980 revenues are maximized at roughly $30 billion for royalty levels between $3.50 and $7.00/bbl. With higher non-OPEC supply elasticity (0.67), 1980 revenues can reach only $25 billion, for royalty levels between $3.50 and $5.25/bbl. For higher income elasticity of demand (1.5) 1980 revenues reach $35 billion, at royalty levels between $3.50 and $7/bbl. The general conclusion is that $3.50/bbl royalty, half the current level (1974), is most likely to occur in the long run; even with more favorable assumptions for OPEC it should not exceed $5.00/bbl.

Levy [1974] concludes that with Saudi Arabia/Kuwait/Abu Dhabi acting as residual supplier, then current price levels (1974) were likely to be sustainable through 1980 if the demand growth rate is at or slightly less than recent historical rates. At much lower growth rates (2.7 percent per annum), however, the supply restriction and revenue reduction for these three countries would be so great that current price levels would not be

maintainable. The FEA, on the other hand, considers two possibilities: one, that OPEC will act as a unified bloc, and second, that only a six country sub-group (Saudi Arabia, Kuwait, Libya, Iraq, the UAE and Qatar) will be willing to restrict output.

Considering OPEC as a monolith, each OPEC member restricting output to the same percentage of capacity, sustaining a price of $9/bbl would imply by 1985 that each would have enormous surplus capacity (46 percent). To sustain $6/bbl, all members must share a 7 percent surplus. With $3/bbl, a shortage would exist by 1985. This is under the assumption that the six mentioned members are restricting output by an equal percentage of capacity. To sustain $9/bbl the residual suppliers must have 52 percent surplus capacity by 1985. For $6/bbl a 12 percent surplus would have to be shared. $3/bbl is not feasible [Federal Energy Administration 1974].

B- Blitzer-Meeraus-Stoutjesdijk (B-M-S) [1975]. According to B-M-S, the problem facing OPEC, or any subgroup thereof, is straight forward: an inelastic short-run demand curve permits high prices and revenue today but at the expense of revenue in the future, as OPEC market share is lost to other producers and to alternate fuels. The actual demand for world oil (D_t) is defined as;

$$D_t = D_0(1+g)_t \, P_t^c \text{ where } -0.05<c<0$$

D_t =actual level of demand for world oil in year (t),

D_0 =world demand in year (t),

g =demand growth rate,

P_t^c =oil price in year (t), (c) is constant elasticity which is somewhere between 0 and -0.05.

Where the demand for OPEC oil is;

$$X_t = D_t - S_t^{Non-OPEC}$$

Thus, their basic objective is to identify the price pattern over time which best satisfies the dual objectives of maintenance of market share and high current revenue, as apposed to simply a maintainable constant price. Obviously, 'best' implies some objective criterion, which in this case is the value of net foreign asset holdings in 1995 (defined as the accumulated difference between export revenues and import spending) plus the (undiscounted) value of oil still in the ground at that time.

B-M-S evaluate the relative merits of the price trajectories considered under two assumed states of the world. First, OPEC as a whole agrees to any necessary prorationing (as a monolith). The result is that OPEC should reduce the price from its current (1975) level . The main reason for the optimality of price reduction strategies is the necessity of discouraging investment in alternatives and preserving market share.

Second, using a hypothetical example of a sub-OPEC cartel for illustrative purposes, Saudi Arabia, Kuwait and Abu Dhabi are assumed to act as the price-maintaining residual suppliers, with other OPEC members producing at currently projected capacity, exactly as non-OPEC producers. The results of this case would seem to confirm the results of the basic case, that a price-reduction, output-increasing strategy is optimal. Such strategies would be especially attractive for the three countries acting as residual suppliers. Price-maintenance or price-increase policies, on the other hand, would imply such unreasonably large restrictions in output by Saudi Arabia/Kuwait/Abu Dhabi that they would not be likely to cooperate. These results depend upon the assumed value of the zero-export-growth price. I will prove the notion of price-maintaining residual suppliers using cooperative solutions to enlarge the mutual benefits to the members. However, although a criterion is used to evaluate the price paths

explicitly postulated, there is no optimization involved in the selection of price paths to be simulated. Thus, although the B-M-S results are more general than those of Kennedy, Levy or the FEA, there is no guarantee that they actually found the 'best' strategy for either OPEC or the Saudi Arabia, Kuwait and Abu Dhabi sub-cartel.

C- Kalymon [1975]. In recognition of this problem with simulation models, Kalymon has proposed a model which is explicitly optimizing in structure. In this model, optimal price trajectories over time are calculated for both OPEC as a monolith and for several sub-OPEC coalitions. In each case, the criterion to be maximized is the total discounted benefits from oil production and sales accruing to the price-setting residual supplier. OPEC as a whole or a sub-OPEC group such as Saudi Arabia/Iran or Saudi Arabia, Kuwait, Abu Dhabi and Qatar. The model assumes the total demand equals export demand [$f_{te}(P_{te})$] plus domestic demand [$f_{td}(P_{td})$]. The objective is to maximize total benefits to producers, which is equal to total revenues (export and domestic) - total cost. The resource exhaustion constraint; $q=Q$ assures that the total production over the years of oil utilization does not exceed the total reserves (Q).

By obtaining the price trajectory from an optimising model, Kalymon seeks to avoid (or at least reduce) the possibility that a complex, but optimal, price strategy will be overlooked. In addition, the specification of the model permits optimal strategies for sub-groups of the cartel to be examined merely by altering a few key parameters.

Kalymon's conclusion is that the optimal price path for the basic parametric values requires an immediate price reduction to $8.68/bbl, then a 1 percent per year price increase until a price of $15/bbl is reached in the year 2027, and reserves are exhausted. The strategy requires a large measure of production restriction.

As with the B-M-S model, Kalymon's model can be viewed as more OPEC-oriented, insofar as the model strives to identify price trajectories that are best from the producers' point of view. Obviously, however, the results are of interest to policy makers within the importing countries, since rational responses and policies cannot be devised without adequate knowledge of the viable options available to the exporting countries.

D- Bohi-Russell. An alternate approach to an optimizing model can be found in the work of B-R [1975]. The dual objectives of the authors are to forecast the actual price (or range of prices) for OPEC oil in the future, and to evaluate the log-run stability of the OPEC cartel. However, although a utility-maximization process is assumed for each member country, the model is only implicit and judgemental. Rather than specifying explicit functions, B-R identify the key variables and constraints entering the optimization problem facing each member of OPEC, then provide an intuitive assessment of the likely net impact of these variables on each country's behaviour. While explicitly assuming that collusion on a prorationing scheme will not take place, what B-R seek to identify are the conditions under which prices will remain high despite the lack of such cooperation. OPEC is not likely to break down. The countries with the power to disrupt the cartel do not have the incentive; those that have the incentive (the will to increase their output) do not have sufficient reserves to threaten the cartel. As in the FEA report, an avowed objective of B-R is to identify the likely OPEC behavior, with a view towards appropriate U.S policy responses.

E- Nordhaus. Although not really a model of OPEC, but rather an answer to the "limits to growth" literature, Nordhaus's model of the world energy market also must be included in any survey of OPEC behavior. The reason for this is that Nordhaus's simulation study remains the only model which

is both global in scope and which permits explicit substitution between several alternate forms of energy. Moreover, by basing his simulation on an assumption of a competitive market, Nordhaus's results provide a useful point of comparison with the non-competitive models just discussed.

In Nordhaus's model the world energy industry is simulated over a 200 year time horizon, for five ten-year periods, two twenty-five-year periods and two fifty-year periods. The objective is to meet given final demands in various locations in each time period at minimum cost, assuming competitive supply conditions. Since the model looks at several distinct intervals, and assumes that demand and supply fully adjust to the price prevailing in each period, it has been categorized here as a dynamic optimization model. Its principal output are competitive (shadow) prices for each fuel over the planning horizon, as well as a time profile of consumption of each fuel. Nordhaus concludes that the long-run shadow price for oil is not optimistic, the competitive oil prices do not rise above $3.20/bbl throughout the remainder of this century. A high interest rate keeps royalties low initially, but when they rise they really take off. Thus, in addition to providing competitive prices against which the results of the previous models can be compared, Nordhaus also provides a careful look at possible patterns of energy use in the future. In Nordhaus's model as well as Kalymon's model, the price trajectory is exactly of the form predicted by Hotelling (1931) in his classic theoretical study of depletable resources.

3.1.2 OPEC stability so far:

In many cases, no clear criterion is given to determine conditions under which OPEC would be stable. For example, the FEA study finds that with an oil price of $6 OPEC would have a "substanial" excess capacity of 7% in 1985, but it leaves it open whether this would be acceptable to OPEC

members or not. This case is typical of all the models, with the exception of B-R. No explicit optimizing models for individual members of OPEC are specified and therefore no way exists to determine whether each individual country would be better off in accepting the necessary export restrictions or in producing at full capacity and taking into account the likely reactions of other OPEC members. The individual country's actions and reactions can only be observed within the scope of cooperative and non-cooperative behaviour, as will be discussed later on in the Chapter.

Only a small number of market restriction schemes for OPEC or some sub-OPEC cartel are considered: (1) each member restricts or expands output so as to maintain 1975 market shares, up to capacity (Kalymon); (2) restrictions proportional to current capacity (FEA). In many cases, the supply-restricting group, the group of producers who are likely to reduce their current production in order to prevent a price fall, is treated as a monolith, without specification of a mechanism for sharing excess capacity. There is no distinction between the willingness of cooperation of the members. No formal investigation is undertaken concerning which schemes (if any) would be mutually acceptable to all of the supply-restriction group. It seems clear to me that a proportional distribution of excess capacity would not necessarily elicit the agreement of all members and thus is not the most likely outcome. Agreement might be reached, however, if countries with a high time-preference are assigned little or no supply restriction, while countries with a low time-preference are compensated for output restrictions in the near future by enjoying a larger market share in the more distant future. This aspect is taken into account to some extent by the consideration of various subcartels, especially of countries with a low time-preference, such as Saudi Arabia, Kuwait and Abu Dhabi (Levy, B-M-S, Kalymon). However, even in these cases there is no formal search

possible over the various sub-groups or over the variety of schemes to share output restrictions within each subgroup.

Even the most explicit model of OPEC stability, the B-R model, does not hold up under closer scrutiny. From the fact that Saudi Arabia is indifferent between selling oil at $7.33/bbl today and at $10.00/bbl in 15 years, they conclude that Saudi Arabia would reduce its exports at prices below $7.33/bbl, as long as it expects to be able to sell it at $10.00 in 15 years. But this conclusion is not warranted. Even if Saudi Arabia would sell the marginal barrel of oil at $ 7.33/bbl today, it would still have plenty of oil to sell at $ 10.00/bbl in 15 years. The result of deferring sale of that barrel will be to defer exhaustion of reserves, for example, until 51 years in the future instead of 50 years (to use B-R's reserve estimates for the Gulf region). But the discounted value of a barrel of oil sold 50 years later at $10, even at a very low discount rate of 3%, is only $2.23/bbl. Hence, Saudi Arabia's "trigger price" would be $2.23/bbl, not $7.33/bbl [Fisher 1975].

There may well be other reasons for expecting OPEC to be stable, but they will hardly be found in optimization by individual countries, without taking the likely reactions of other countries into account. The proper framework to analyse the stability of a coalition is cooperative and non-cooperative n-person game theory, which explicitly considers bargaining situations, introduces threat points, allows for side-payments to reluctant coalition members who are tempted to disrupt an agreement, etc.. None of the models surveyed goes into these aspects. The assumptions made by B-R are quite restrictive, and any policy conclusions based on them are speculative at best. At this point the Hnyilicza and Pindyck (H-P) model, in which the Nash cooperative solution is used, casts more light on the question of OPEC behavior and stability. There follows a review of some of

these models:

A- Adelman [1982]. According to this model, each OPEC member is quite aware of the mutual interdependencies that exist among producers and, for the common good, producers are willing to share the burden of output reductions by adhering to some kind of formal or informal prorationing scheme. In any event, widespread cheating is unlikely since all participants are aware of the disastrous outcomes if cartel discipline were to evaporate. Accordingly, a collapse of the cartel price seems unlikely and real price increases, even in the face of flat or declining OPEC exports, are quite possible.

Adelmans's view is that OPEC will attempt to raise the price even higher, because of internal pressures within OPEC from producers outside the Gulf. As these producers begin to run budget deficits, they will demand that the Saudis and others in the Gulf Core go along with higher prices. While the Saudis are anxious to avoid these pressures and are seeking agreement on long range pricing objectives on this account, they are nevertheless likely to submit to these pressures because the value of the OPEC states outside the Gulf is considerable. Providing the real price increases were not large and production in the Cartel Core does not fall below certain thresholds, this model would seem to predict price stability and continued OPEC vitality. Unfortunately, this model is very much assigned to oil market developments in the 1970s, where there had been no stop to oil price increases. Oil business seemed to have functioned differently in the 1980s, as will be shown in the next section.

B- Teece and Johany. The model by Teece rests on the assumption that absorptive capacity is limited in the short run and that artificially low discount rates are used, at least implicitly, in production planning. Both factors result in very conservative production policies, so long as oil

revenues meet budgetary requirements (which in turn depend on absorptive capacity), and so long as low real returns on liquid financial assets reinforce (myopic) expectations that oil in the ground is a better investment than money in the bank.

However, a prolonged period of soft crude prices can permit the growth in absorptive capacity to outstrip current revenues. This will induce a tendency toward output expansion. Additionally, if real returns on foreign financial assets continue at historically high levels, many countries may decide that foreign assets are a desirable component of their investment portfolios, and will expand production simply to build foreign assets. Both factors will tilt production decisions toward expansion, with additional capacity being added if necessary [Teece 1982].

In Johany's view production policies are considered matters of national sovereignty; it will not be easy for OPEC to hold the line through collective action. The Saudis might well be pressed to cut back production, at least until production is down to about 7mb/d. However, Saudi resistance to further reductions would be met at about this level. Since OPEC will have difficulty achieving formal prorationing, the price might very well fall dramatically. This is all the more likely if Iran-Iraq relations are improved. Such a development would create budgetary demands in both countries. While this rather optimistic scenario could of course be upset by political turmoil, the implication is clear: Teece's model suggests that substantial downward price movements are likely in the event of a prolonged soft market.

C- Moran [1982]. This is not an economic model, but rather a political view. It argues that twentieth century history is replete with examples of the important security and political ramifications of oil. Thus it seems likely that nation states are simultaneously concerned with extending their

political influence, assuring their own security, as well as maximizing the wealth from their oil reserves. The critical question is the degree to which these goals are mutually compatible or in conflict.

If these gaols are mutually compatible, or complementary, there is really little need for political models of OPEC behavior. Even though "wealth maximization" is merely serving as a surrogate for security and power goals, the predictions of the model should be accurate. Moreover, since wealth-maximizing behavior does involve an empirically measurable phenomenon and economic theory has isolated the factors influencing the choice, the model gives neat, explicit interpretations of the present and predictions of the future. In contrast, once political scientists begin to talk of security or political influence, the model necessarily becomes qualitative instead of quantitative. The predictions necessarily become more ambiguous. Thus, in this case, explicit political models may provide more intuitively pleasing assumptions, but a much weaker predictive model.

The more interesting case is one in which wealth maximization, security, and political influence, etc., are substitutes to some degree. Thus the decision to choose, for example, more security necessarily implies less wealth and/or influence. In this case, political models and wealth maximization models offer divergent interpretations and predictions.

D- Hnyilicza and Pindyck (H-P) [1976]. In 1976 Pindyck developed an optimal pricing model in which OPEC, facing a net demand for oil that is the difference between a dynamic total demand function and a dynamic supply function for 'competitive fringe' countries, and subject to production costs that rise as reserves as depleted, sets price over time to maximize its sum of discounted profits [Pindyck 1976]. While studies such as this, and others constructed by Cremer and Weitzman (1976) and Kalymon (1975), provide a useful first approximation to cartel behavior in that they

describe how pricing policies depend on the inherent dynamics of reserve depletion and short-term lag adjustment, they do not account for the fact that many cartels are composed of producers with different objectives and different degrees of bargaining power. Cartel policy in fact represents a negotiated agreement that reflect the different interests of the member producers.

In his model Pindyck [1978] calculated the relative gains to OPEC producers from cartelisation. In this approach, the cartel, even acting as a unit, is not the only seller in the market. Some production comes from a 'competitive fringe', small producers who take the price set by the cartel in each period. The cartel, in turn, takes account of fringe supply in setting prices. With the additional (and crucial) assumption that fringe supply adjusts with a lag, a price path can be determined to maximize the present value of cartel profits. He concluded that OPEC gains from cartelisation are quite large, hence there would be sufficient incentive for OPEC producers to over-come the problems typical of cartelisation.

In the model of Pindyck and Hnyilicza [1976], OPEC was assessed as two groups. It consists of one group of saver countries (Saudi Arabia, Libya, Iraq, Abu Dhabi, Bahrain, Kuwait, and Qatar) that have little immediate need for cash and would thus use a low rate of discount in computing a sum of discounted profits, and a second group of spender countries (Iran, Venezuela, Indonesia, Algeria, Nigeria, and Ecuador) with large cash needs and a higher rate of discount. These groups also happen to differ with respect to the proven reserves available to be depleted over time; saver countries as a group have considerably greater proven reserves than do the spender countries. The differences in discount rates and reserves will reinforce each other in terms of creating differences in desired policies for each group. Actual cartel policy depends on an agreement between the

two groups that reflects both differences in objectives and in bargaining power.

The model seeks a bargaining solution for the two-part cartel based on the theory of cooperative games developed by Nash [1950]. First, they find optimal trajectories for both price and the ratio of output shares, assuming the cartel maximizes a weighted sum of the objectives (sum of discounted profits) for each of the two groups of countries. Second, by repeatedly changing the weights, resolving and recomputing optimal sums of discounted profits for each group, they compute an efficient (Pareto-Optimal) frontier in the space of realised objectives for the two groups of countries. Next, that set of weights which corresponds to a Nash cooperative solution is found. This corresponds to the bargaining solution, and gives the optimal trajectories for price and market shares.

The study assumes that a cooperative agreement is worked out whereby price and output shares are set to maximize a weighted sum of the objectives of each group of countries;

$$\text{Max.} \quad W = \alpha W_1 + (1-\alpha)W_2 \text{ , where } 0 \leq B_t \leq 1$$

By varying α between 0 and 1 and solving the resulting set of parametric optimization problems, the Pareto-optimal frontier is obtained in the space of realised outcomes (W_1, W_2), as in Figure 3.1. Clearly, each point on the frontier corresponds to a different trade-off between the relative objectives of the two groups of countries. The frontier need not touch the W_1 or W_2 axes. When $\alpha = 1$, for example, no weight is assigned to W_2, but the policy that maximizes W_1 might result in a W_2 greater than zero.

Determining the value of α that is most likely to prevail as a result of a negotiated agreement between the two groups of countries requires the

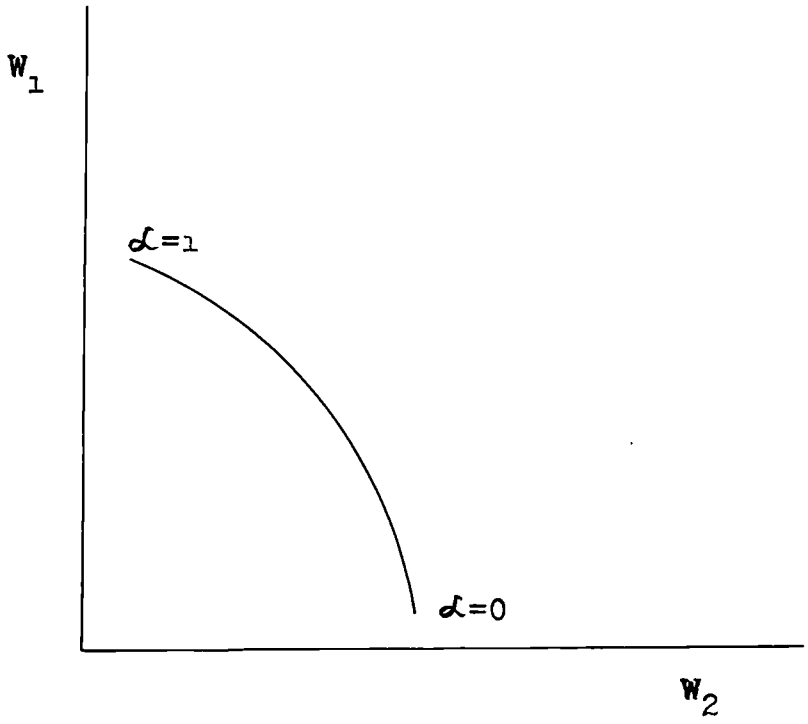


Figure 3.1 Efficient frontier

solution of a cooperative two-person game, introduced by Nash in 1953 [Nash 1953].

The idea is that the two parties in a bargaining game attempt to move along the set of bargaining outcomes in opposite directions, the problem is to determine a meaningful measure of bargaining power for the two parties. Nash's approach, for a non-cooperative solution [Nash 1951], was to introduce the notion of a threat point which I will attempt to develop, i.e. the outcome that would result if negotiations were to break down and non-cooperative behavior were to ensue.

The model concludes that if output shares are fixed the two-part cartel will choose the same pricing policy as the monopolistic cartel. This policy was stated by the exhaustible resource theory discussed in the previous Chapter. However, the model also stresses that output allocation is likely to be an important aspect of OPEC policy, particularly in the future as the supply of oil from the competitive fringe countries increases and OPEC is forced to cut back its production. The H-P model stood short of tackling the notion of non-cooperation behaviour. To foresee the likely outcome of OPEC stability, we should trace the non-cooperative behaviour as well as the cooperative.

In a cooperative solution it would be irrational for either party to accept a payoff less than that resulting from non-cooperative behavior. In broad terms, Nash's solution is based on the premise that the relevant measure of "relative power" which determines the outcome of the bargaining process is given by the relative utilities at the status quo, or point of no agreement. This is plausible, since the reason each party is willing to bargain is that it expects to accrue a payoff over and above the payoff attained at the threat point. It seems reasonable that both parties should be willing to accept a division of the net incremental gains in a

proportion directly related to the losses incurred by not making an agreement.

Nash demonstrated that his proposed solution to the bargaining problem is in fact the only solution (W_1^*, W_2^*), see Figure 3.2, that satisfies axioms of rationality, Pareto optimality, independence of irrelevant alternatives, symmetry, and independence with respect to linear transformations of the set of payoffs. Furthermore, that solution is such that $(W_1^*-W_1^0)(W_2^*-W_2^0)$ is maximized.

The model shows that pricing strategy follows almost directly from output strategy, by means of changing output shares between saver and spender countries increasing the profits for both countries. The Nash solution for fixed output shares results in total discounted profits of $2439 billion and $407 billion for saver and spender countries, respectively, as compared to $2778 and $698 billion for the Nash solution with time-varying output shares.

This model assumes that none of the members is reluctant to cooperate, every member is assumed to have chosen to pursue the group interests regardless of his individual interests. Resulting from this assumption, the two subgroups might only disagree; if there is any disagreement at all, at one point, the point of no agreement (threat point), at which both parties would be worse off. The fact is that individual members have to fulfill their individual interests as well as the subgroup interests, and they may value their individual interests as much as the group interests and perhaps more. Thus the individual member may not only be unaware of the consequences of non cooperation, they may willingly choose not to cooperate within one particular group or another. Any movement of this kind may change the threat point position and shift the Nash cooperative solution point (see Figure 3.3).

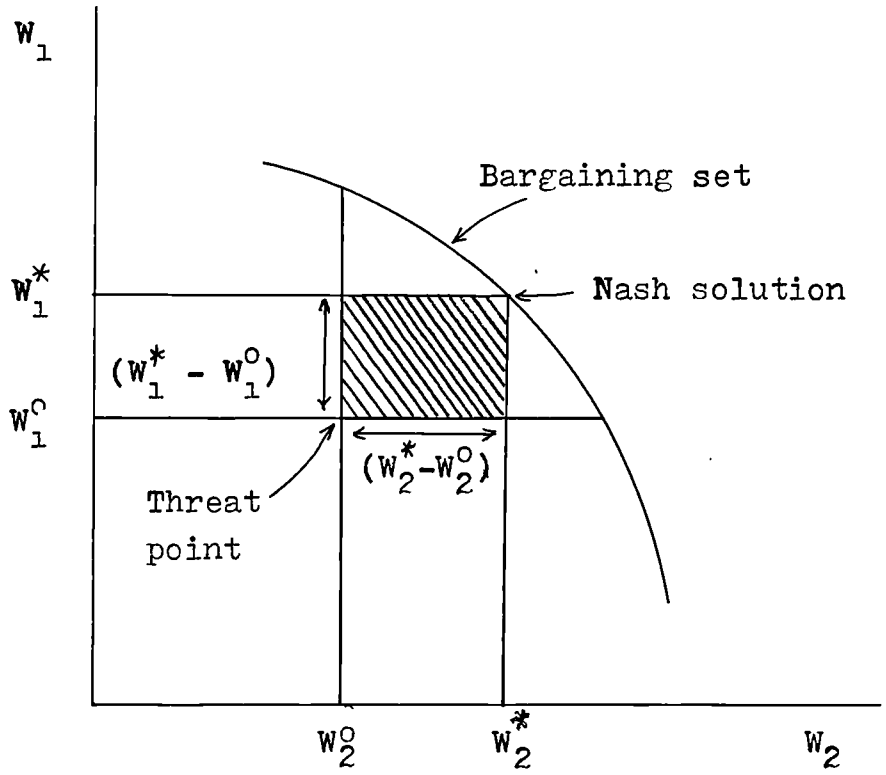


Figure 3.2 Nash Cooperative Solution

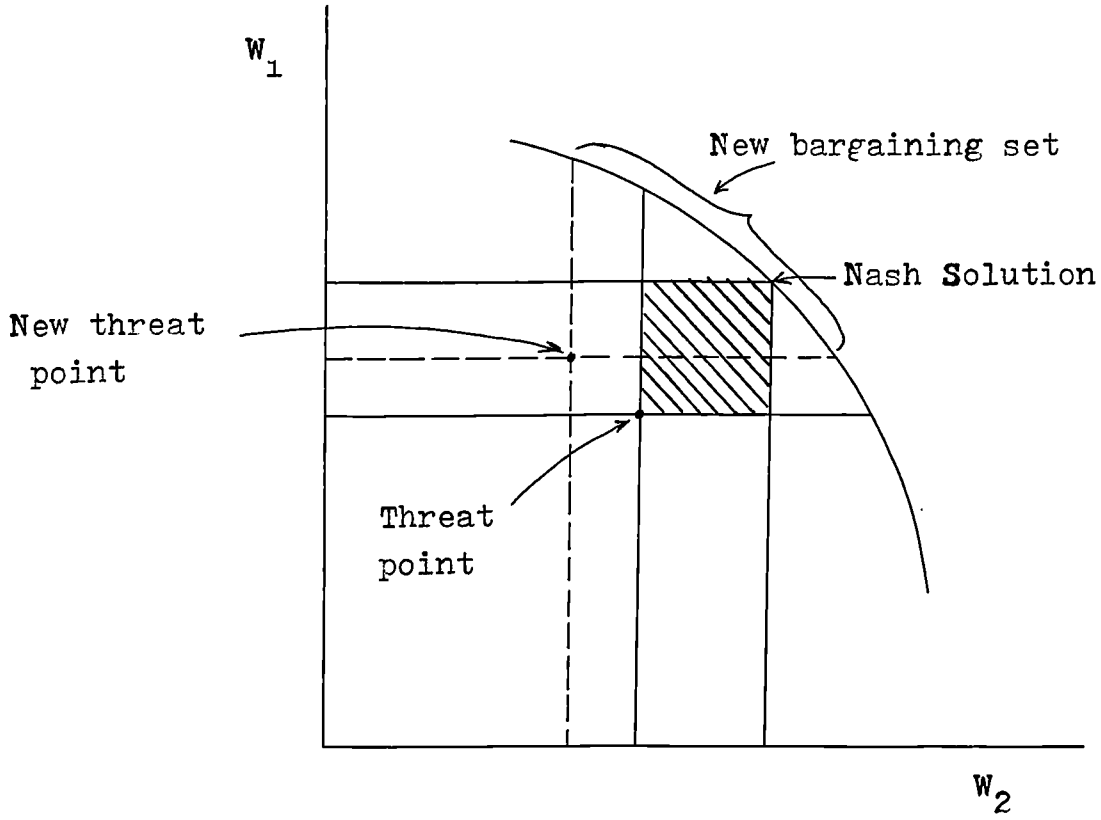


Figure 3.3 Threat point and Nash Solution.

In the ideal situations, such as two person games, there exists a Nash solution or a threat point depending on agreement or disagreement of the players. In organisation games, such as OPEC, the interrelations between members is rather complex and unsettled. Members interests are divided between their individual interests and the organisation or subgroup interests. Thus, in considering such organisations, neither the Nash solution nor the threat point is quite clear. The solution can only be an approximate solution at best, but not definite.

Again the proper framework to analyse OPEC stability is by applying game theory. Non-cooperative solutions together with cooperative solutions can provide a more comprehensive explanation of OPEC behaviour than described hitherto.

3.2 Game theory and OPEC behaviour:

Game theory, like any other mathematical theory, is essentially a collection of theorems derived from axioms [Rapoport 1970 p.11]. Two or more individual players influence a situation (outcome of the game) whereas the interest of the players (their utility for the various possible situations) differ. Differences of the various utilities between the players raises conflictual behaviour just as identity of all utilities makes the game a pure coordination problem where cooperation is the only rational behaviour [Von Neumann and Morgenstern 1947 p.32]. In most games derived from politics and/or economics, the configuration of utilities is neither strict antagonism nor mere identity. The seller and the buyer both agree that their common interest dictates that they reach agreement on exchange, so long as no one is made worse off by the deal; but they eagerly compete for the choice of a particular price within these limits. Similarly two moderate voters typically agree to destroy the extremist but struggle fiercely to support one of the two prominent middle-of-the road candidates. A moment's reflection will convince all of us that most social game-like situations generate tendencies to both conflictual and cooperative behaviour. Game theory, in fact, tries to predict what stable institutional form will emerge from a given economic background and what the resulting value relationships will be.

My aim, from a study to OPEC behaviour, is to show that game theory is a useful logical device to explore these mixed situations. Cooperative and non-cooperative equilibrium concepts will typically coexist.

On the strategy of pure conflict the zero-sum game theory has yielded important insights and advice. But on the strategy of action where conflict is mixed with mutual dependence the zero-sum games involved in wars and threats of war, strikes, negotiations, criminal deterrence, class

war, race war, price war, and blackmail; manoeuvering in a bureaucracy or in a traffic jam; and the coercion of one's own children, traditional game theory has not yielded comparable insight or advice. These are the games in which, though the element of conflict provides the dramatic interest, mutual dependence is part of the logical structure and demands some kind of collaboration or mutual accommodation, tacit if not explicit, even if only in the avoidance of mutual disaster. There are also games in which, though secrecy play a strategic role, there is some essential need for the signaling of intentions and the meeting of minds. Finally, they are games in which what one player can do to avert mutual damage affects what another player will do to avert it, so that it is not always an advantage to possess initiative, knowledge, or freedom of choice.

Traditional game theory has, for the most part, applied to these mutual-dependence games (nonzero-sum games) the methods and concepts that proved successful in studying the strategy of pure conflict.

Real economic problems are usually of the non-constant-sum variety. For example, collusion can normally increase the total profits of a pair of duopolists [Bacharach 1976 p.67], and two countries can usually do better by getting together than by declaring war on one another.

The mutual interdependence of OPEC producers suggests a possible application of game theory to an analysis of OPEC. Game theory may not provide a definite solution to the price and output policies of OPEC, but, as I hope to show, it provides a framework for structuring an analysis of OPEC.

It is obvious that it is the non-zero sum game which is applicable to OPEC. As will emerge from the analysis, OPEC price-output strategies conform neither to a cooperative or a non-cooperative non-zero sum game. Generally speaking OPEC countries resort to both cooperative and

non-cooperative strategies.

In the literature, non-constant-sum games are divided into two classes: cooperative and non-cooperative, i.e., into games where collusion occurs and those where it does not occur.

In the cooperative case the game theorists have tended to argue that the players will be sufficiently rational to discover and make full use of all opportunities which can mutually be advantageous. That is, the players are taken to cooperate on any and every action which can increase the payoff of either player (provided it does not, at the same time, reduce the payoff of the other). In economic terminology, they will always end up somewhere on the contract curve of the Edgeworth box [Bacharach 1976 p.144].

Of course, it is doubtful whether players are really so rational in practice. Moreover, the problems involved in arriving at an acceptable division of the "*take*" may well prevent the players from maximizing their total gain as this rationality assumption requires. It is note-worthy that most of the novelty in the cooperative-case analysis occurs in investigation of the division of the spoils between colluding players. The objective of OPEC producers is to maximize their revenues, but where the price is fixed this can only be done by increasing output. The problem is that the violation of an output agreement or quota by any member necessitates a direct cut of some other member's quota. This sort of action is really a step towards non-cooperation, because it threatens the others with being unable to maximize their revenues. Nash has supplied a criterion for a reasonable or "*fair*" division which has been the subject of considerable attention [Nash 1953]. The application of the cooperative solution was discussed in the previous section from the work of Hnyilicza and Pindyck. Their model is centred on the concept of cartelisation. The main goal of the members is to maximize their revenues. To do this they

need to cooperate with each other, leaving aside the possibility of non-cooperation behaviour. However, the game would be better understood if non-cooperation elements were also considered, because as I have discussed earlier in the Chapter the change in the threat point would affect the ultimate solution.

In general, a cooperative solution is at least as good as a non-cooperative solution for the simple reason that a non-cooperative solution is always a cooperative solution (an agreement to disagree). The OPEC countries will always have a higher revenue if they act as a unified cartel. But a cooperative solution raises the problems of:

(1) The division of the overall pay-off among participants.

(2) The monitoring and policing of agreements on output quotas and prices.

(3) The non-cooperative alternative to a cooperative solution.

In recent years OPEC has not acted as a unified cartel. For example African producers, competitors to North Sea oil, especially Nigeria, reduced the price of their crude following the British National Oil Corporation (BNOC) price reductions in March 1983 and October 1984, regardless of the OPEC official price. A message delivered by Nigeria's Minister David West, attending the Vienna meeting as an observer, indicated that the previous Lagos regime had overproduced at 1.5 million b/d, (Nigeria's quota was 1.3 mb/d) [Petroleum Economist, April 1983]. But non-compliance with the collective decisions of OPEC is not the only feature of OPEC. Members have kept violations within certain limits and despite the frequent non-compliance with the collective agreement on prices and output quotas, no OPEC member has in fact pulled out of the organisation and all members have continued to participate in price-output agreements. Thus, what is interesting about OPEC is not simply the

non-compliance with collective price and output quota agreements but that this is in conjunction with the survival of the organisation.

Now I turn to the discussion of non-cooperative non-constant-sum games. They posses a number of interesting features:

1. If such a game possesses several equilibrium pairs of strategies, they need not all yield the same payoff. Moreover, if (a,b) and (a_1,b_1) are equilibrium pairs, neither (a,b_1) nor (a_1,b) need be equilibrium pairs. This can greatly complicate the planning problems of both players since, if they do not aim for the same equilibrium pairs, both may lose out.

2. The second peculiarity of the nonzero-sum, non-cooperative case is that both players will often be led by self-interest to take decisions which are mutually disadvantageous. This has been illustrated sharply by the well-known game of *the prisoners' dilemma*, which is attributed to A. W. Tucker [Kuhn and Tucker 1950]. Two prisoners are brought in and interrogated separately. Each knows they will both get off if neither person "talks". However, they are both told that if one confesses and the other does not the one who fails to confess will receive a particularly heavy penalty. In this situation both players may well decide to protect themselves by confessing.

This point is of considerable economic importance. It shows why citizens may not contribute taxes voluntarily even though each wants the government to function. The citizen sees nothing to be gained by paying taxes unless there is some guarantee that others will contribute too, just as one prisoner will confess unless he has some assurance that his fellow prisoner will not do so. Similarly, where it is legally possible, many storekeepers will keep their shops open on Sunday although they all prefer a holiday, each fearing that if he does not do so he will lose customers to his competitors. This argument is involved in the logic behind conscription

and rationing in wartime, governmental anti-inflationary measures, etc. All of these measures are designed, at least in part, to achieve the cooperation which alone can prevent the loss to each player from his trying to protect himself when he has no assurance that others will behave as required for their mutual interest [Baumol 1965].

Furthermore, in Chapter 7 I will present a case of what I might call the "*Libyan producers' game*". In this game the foreign oil companies working in Libya, had actually mistrusted each other's behaviour and thus eliminated a possibility of a cooperative outcome of the game. They, in a sense, had been in a similar dilemma to that faced by the prisoners. The non-communication problem of the prisoners had eventually, in the mind of each prisoner, been transformed to a mistrust problem as we will see below from their choice of strategies.

Because there is no communication between the prisoners, strategy 1, which is best for both players, cannot be chosen. For both players strategy 2 dominates strategy 1 (see matrix below). Hence, strategy 2, (10,10) is the unique dominating strategy equilibrium, therefore a non-cooperative solution is the eventual outcome. However strategy 1 (cooperation) provides less imprisonment to both prisoners. Therefore non-cooperative selfish rationality conflicts with collective interest arguments. Collective interests demand sticking to cooperative strategy 1 [Moulin 1981].

Prisoner A	Prisoner B: 1	Prisoner B: 2
1	2 (2)	6 (12)
2	6 (12)	10 (10)

In the absence of disclosure, there is little room for manoeuvering, but the solution certainly would not be the cooperative one. On the other hand the solution cannot be the extreme non-cooperative one (12,12). That is the authorities have clear evidence that both prisoners committed the crime but neither confessed. Eventually both prisoners will confess and get ten years imprisonment each (see Figure 3.4 below).

On the surface the frequent non-compliance with the collective output and price decisions may suggest that OPEC countries are caught in a prisoner's dilemma, but some of the principal features of the dilemma do not apply to OPEC.

(1) The prisoner's dilemma is characterized by a complete absence of any communication between the participants. The lack of communication is the central feature of the dilemma.

(2) There exists no mechanism for enforcing any prior agreement on cooperation. Neither party can make a credible threat in the event of non-compliance by the other party.

(3) Neither party has means to know immediately the behaviour of the other party.

(4) This is a one-off game, it happens only once in a life-time, there is no previous experience to learn from.

(5) Players preferences go in opposite directions: the choice that each prefers to make is not the choice he prefers the other to make. Each prisoner prefers to be the only confessor. The strengths of these preferences are such that both are better off making their unpreferred choices (not to confess) than if both make their preferred choices [Schelling 1978 p.216].

The prisoner's dilemma is the archetypal choice problem in which, contrary to the doctrines of liberal economics, the group interest is not

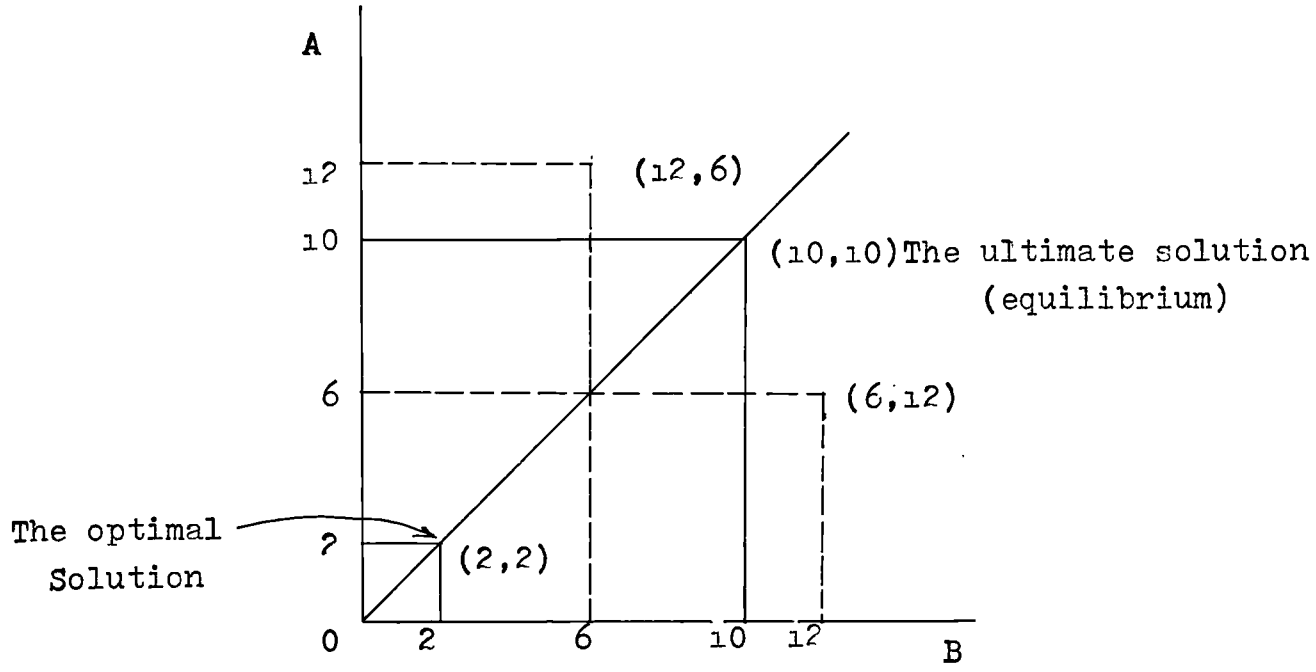


Figure 3.4 Prisoners Dilemma

furthered by the independent pursuit of individual interest. *Prima-facie* the dilemma seems eminently applicable to OPEC. It is clear that as a group, OPEC will maximize revenues if all members adhere to the jointly agreed price structure and output quotas, yet the interest of each member may diverge from the interest of the group. Furthermore, the interests of some members may coincide forming sub-groups such as Output Maximizers, Price Maximizers and Cartel Core. These divisions were discussed in Chapters 1 and 2. The point to make here, as I showed in the previous section, is that divergent interests between OPEC members may well lead to a new threat point, which accordingly results on a new equilibrium point (solution). This certainly means a change either in price or output agreements. Thus, in contradiction to the Hnyilicza and Pindyck model, I stress the necessity of defining the threat point, as a first step, before any search for a solution. In discussing the possible application of the dilemma to OPEC I distinguish between the following:

(1) Preference about one's own behaviour or the sub-group behaviour.

(2) Preference about the behaviour of the other members or sub-groups of OPEC.

Having reached an agreement on the structure of prices and output quotas, each OPEC member prefers to stick to the agreement. That is, each member prefers others to pursue the group rather their own parochial interests. On the other hand, the member in question prefers to pursue his own self interest and thus may prefer to violate the price and production quota agreement. He could do that unilaterally or bilaterally through his sub-group. The price-output agreement would break down if each member pursued his own interest while expecting others to put the collective interest above their own individual interests.

The history of OPEC brings about vivid examples of violation and

accommodation situations. For example, when the demand for OPEC oil fell from about 23 mb/d in 1981 to 19 mb/d in 1982 [El-Mokadem 1984 p.35] some OPEC members such as Saudi Arabia, Kuwait, and the UAE reduced their production to prevent the fall in price. Another example was in October 1984, when the North Sea oil price was reduced and Nigeria followed. Saudi Arabia announced that it would cut its production in an attempt to limit further price reductions. Thus, while Nigeria violated the price-ouput agreement, Saudi Arabia tried to protect the collective agreement on the account of its individual preference. Shortly after that, on 29 October, OPEC ministers agreed to reduce their production by 1.5 mb/d, to 16 mb/d, as shown in Table 3.1 below.

Table 3.1

Change in OPEC's quota (mb/d): 1982-1984

Country	March 1982 quota	Reduction	Oct. 1984 quota
Algeria	0.725	0.062	0.663
Ecuador	0.200	0.017	0.183
Gabon	0.150	0.013	0.137
Indonesia	1.300	0.111	1.189
Iran	2.400	0.100	2.300
Iraq	1.200	-	1.200
Kuwait	1.050	0.150	0.900
Libya	1.100	0.110	0.990
Nigeria	1.300	-	1.300
Qatar	0.300	0.020	0.280
Saudi Arabia	5.000	0.647	4.353
U.A.E.	1.100	0.150	0.950
Venezuela	1.675	0.120	1.555
Total	17.500	1.500	16.000

(-) The quota has not been changed.

Source: Al-Moudjahid (daily news-paper), 1 Nov. 1984, p.6.

We may consider Saudi Arabia/Nigeria's case as a two person game. I define the parties of the game as follows;

(A) Saudi Arabia; the producer who is willing to prevent the current oil prices from falling even if it is forced to reduce its current production level.

(B) Nigeria; the producer who is willing to keep the level of current oil revenues even if this requires reduced oil prices and increased oil production.

According to OPEC agreements, the producers' behaviour is constrained by

the maximum allowable production for each individual producer "quota", and the minimum crude price. The strategies available to both producers according to the agreements were;

(1) Reduce oil production.

(2) Increase oil prices.

If Saudi Arabia and Nigeria behaved within these limits, there would be no problem (normal behaviour of cartel members). The problem is that the parties, or at least one of them, behave differently. That is because the interests of one party oppose the interests of the other and violates the OPEC agreements. The possible violation strategies are as follows;

(3) Increase oil production.

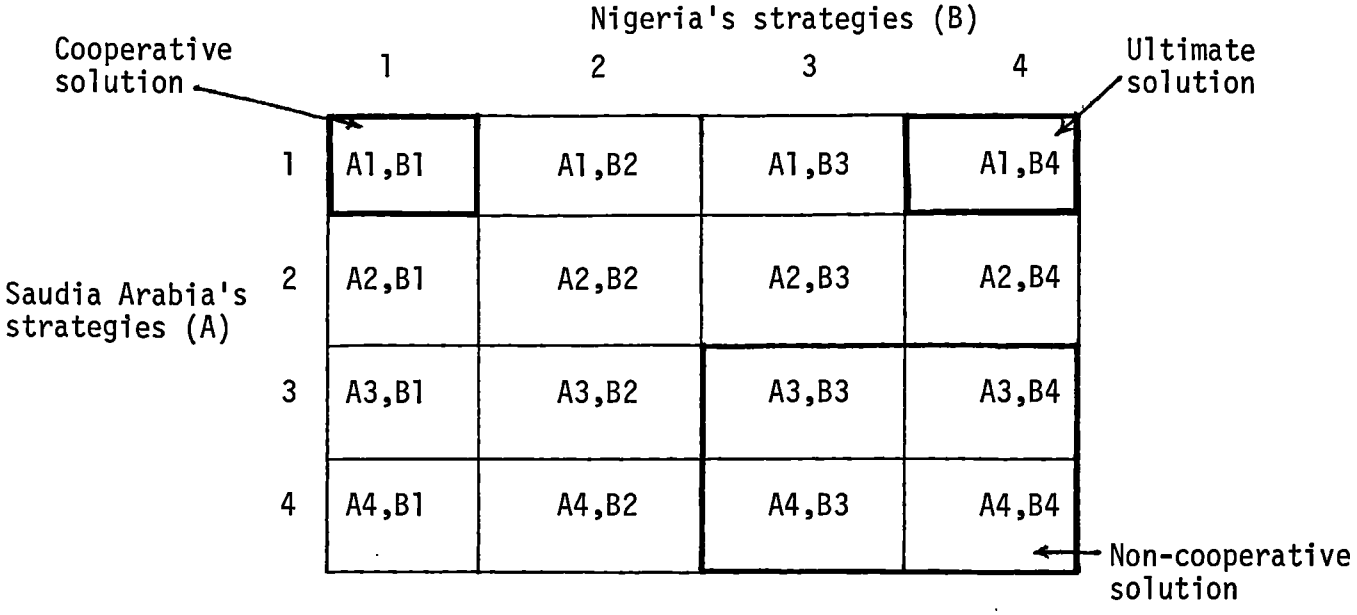
(4) Reduce oil prices.

One might argue that the last two strategies demonstrate the act of cheating in cartel theory. This is true, but under cartelisation cheating becomes widely spread and that would lead to cartel destruction. Here the process is different, while one party violates the agreements by employing strategy 3 or 4 or both, the other party accommodates such an action by employing his strategy 1.

In the matrix below, if Saudi Arabia and Nigeria employed one of their first two strategies, there would be no problem. The parties, as just mentioned, behave in accordance with OPEC agreements. The trouble began when Nigeria decided to fulfil its own interests by reducing its oil prices below the OPEC agreed prices. Nigeria as discussed in Chapter 1, is a heavily populated country with low oil reserves and large development programmes. Nigeria realising its problems, chose its strategy 4 (reduce oil prices) leaving Saudi Arabia to decide on its strategy.

Now if Saudi Arabia acted according to simple cartelisation theory, it would follow Nigeria's choice by employing its strategy 4. The outcome of

the game would be a non-cooperative solution (A4,B4). The implications of such strategy is quite clear; wide-spread cheating within OPEC and consequently its collapse. OPEC collapse would hurt Saudi Arabia more than any other producer in the world, because of its large crude oil reserves. Thus Saudi Arabia wisely rejected strategy 4.



Strategy 3 is an alternative to violation strategy 4, and since strategy 4 was rejected by Saudi Arabia then strategy 3 had to be rejected. Strategy 2 cannot be employed because it is hopeless to increase the price of oil at a time of slack oil demand and declining oil prices. Thus the only strategy which was consistent with Saudi Arabian interests as the largest oil reserves holder, was strategy 1 (reduce oil production). By employing this strategy Saudi Arabia hoped to reduce oil supplies to prevent further price reductions. Thus the solution in this case was (A1,B4).

However, Nigeria also violated the OPEC quota by employing its strategy 3. Even though it violated both the OPEC quota and OPEC prices, Saudi

Arabia in contrast still employed its strategy 1. The ultimate solution was (A1,B3B4).

It should be clear that the outcome of the game was not a cooperative solution which is (A1,B1) in the matrix. On the other hand, the outcome of the game was not a non-cooperative solution (A3A4,B3B4) because as discussed above Saudi Arabia did not consider cheating as a strategy.

If we assume that these two producers represent the adverse interests within OPEC, we may conclude that OPEC did not act as unified cartel. Cartelisation Theory is unable to assess OPEC behaviour. Furthermore the analysis confirms the coexistence of cooperative and non-cooperative behaviour of OPEC members.

The crucial factor to the organisational stability is the number of stabilising producers (K) and their actual output levels. These are the members who choose to stabilise the organisation for some reason such as being large reserves holders, for whom long term price stability is necessary to maximize the sum of their profits. If the ability of these stabilising producers to reduce production (K_p) is large enough so as to absorb or accommodate any increase in production (O_p) by other members, OPEC will be stable. ie. stability requires:

$$O_p < K_p$$

The unstable position would be of the form [$O_p > K_p$].

Even though, OPEC members have no communication problem, and output as well as prices are agreed upon in the conference, there is still a possibility of violations by some members. At a certain point, beyond the accommodation limits, these may bring unrest for the organisation or at least generate a non-cooperative solution. Threat and accommodation are the features of OPEC which cannot be found as such in the prisoner's dilemma.

3. In a non-cooperative, non-constant-sum game it will often pay a player to publicize his plans, in marked contrast with the rather obvious advantage of secrecy in the zero-sum case. Disclosure may be useful either as a means of transmitting information or as a threat which permits a degree of tacit collusion.

(a) Information. Under competition a company will often make certain that any price increases are well publicised in the hope, or even the confident expectation, that this move will soon be followed by other firms in the industry, to their mutual advantage. For OPEC members, the price and output are agreed upon, precise information helps coordination between members and on the other hand could help in detecting any violations to the agreement.

(b) Threat. Game theory offers a variety of examples for individual threat. These are not applicable to organisations, but they help to clarify the communication concept. For example, to a player who announces that he will drop a bomb which will blow everyone up if he does not have his way, disclosure of this information is necessary for him to win his point. Curiously, a reputation for stupidity and stubbornness can be useful to the player who poses a threat because it will help convince the others that he really means it [Schelling 1963 pp.21-52].

When one threatens to cut his price if his competitor does, the threat is no more than a communication of one's own incentives, designed to impress on the other the automatic consequences of his act. And, incidentally, if it succeeds in deterring, it benefits both parties. For example, OPEC's threat in 1983 that there would be a price war if Britain continued reducing the price of its crude below the OPEC official price, is of this kind. Nigeria's violation of its quota from 1.3 mb/d to 1.5 mb/d in 1982-83 can be viewed as an enforcement of its request to OPEC members to

raise its quota but not as a credible threat to price agreements.

But more than communication is involved when one threatens an act that he would have no incentive to perform, but that is designed to deter through its promise of mutual harm. To threaten massive retaliation against small encroachments is of this nature, as is the threat to bump a car that does not yield the right of way or to call a costly strike if the wage is not raised a few pence. In the oil industry the Libyan threat, in 1970, to oil companies working in Libya is well known. The threat was to freeze oil production if the companies did not increase the government take to a certain amount. This initiative has had a series effects on the oil industry as a whole. The distinctive feature of this threat is that the threatener has the incentive to carry it out if his demands were not met. He does have an incentive to bind himself to fulfil the threat, if he thinks the threat may be successful. I will be showing for the Libyan case in Chapter 7 that the threat and not its fulfilment gains the end; fulfilment is not required if the threat succeeds. The more certain the contingent fulfilment is, the less likely is actual fulfilment.

The Libyan threat achievement, in fact, rewarded both parties (the Libyan Government and the oil companies). It simply shifted the solution point or Nash solution to the right (see Figure below).

The incremental increase in posted price was divided between the government and oil companies. Libya's gain as a result of the threat is measured by L_1L_2 in the Figure, while the companies' gain is measured by C_1C_2. There was no loss to the oil companies but the advantage of cheap Libyan oil in comparison to other oils was almost removed, and probably more important is that Libyan success in threatening oil companies opened the door to other producers for similar claims. I will be showing, later in this thesis, a complete analysis of Libya's tactic in dealing with the

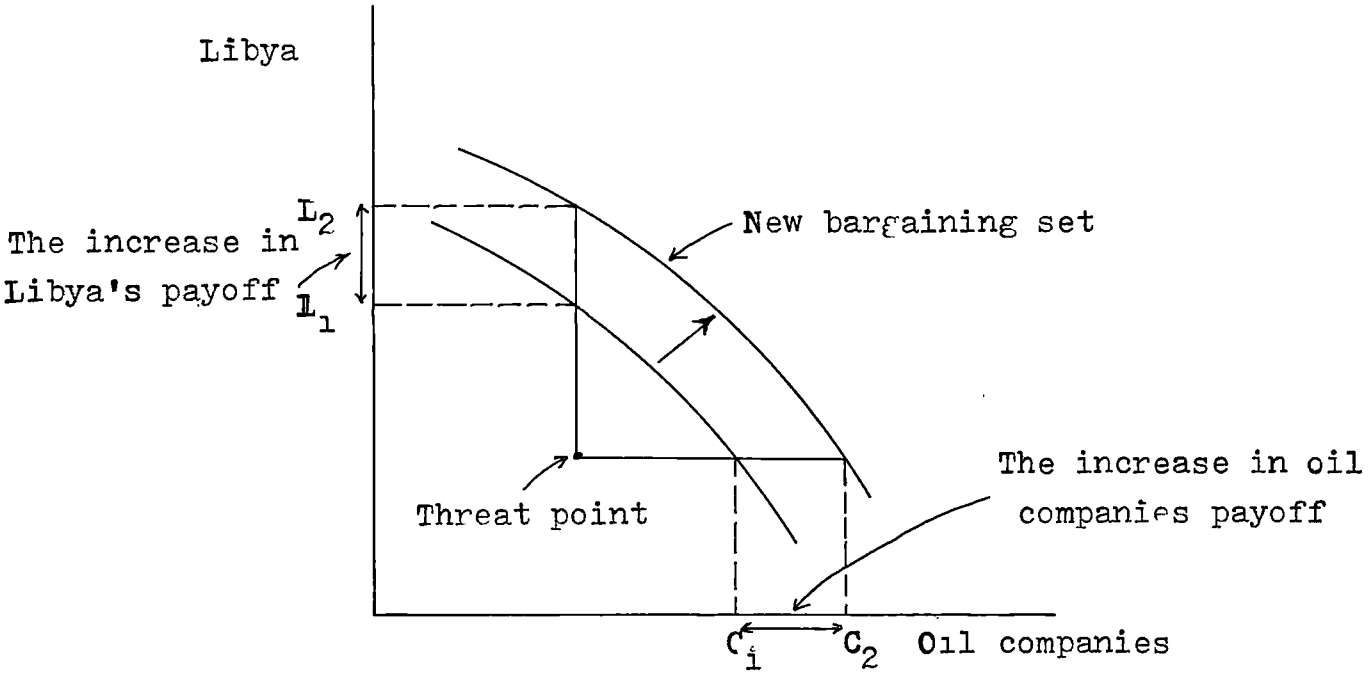


Figure 3.5 Libya and oil companies

oil companies to enforce particular solutions. The above assessment raises an important point which is worth investigating by oil specialists; the increase in oil prices started by Libya have increased the companies profits substantially. This in effect made the oil companies closer in their interests to the producing countries than to the consuming countries. But the threat's efficacy depends on the credulity of the other party, and the threat is ineffectual unless the threatener can rearrange or display his own incentives so as to demonstrate that he would, *ex post*, have an incentive to carry it out. An example of this case (fulfilment) is provided from the treatment of the Shell oil company in August 1973, where its production was embargoed by the Libyan government. The event had no negative effect on the Libyan government while Shell actually lost Libya's low-sulphur crude. In addition, such an embargo made it clear to all other companies that Libya certainly meant what it said, and thus made the threat to oil companies credible.

Once a threat is carried out it may lead to multiple effects by involving other parties not part of the game initially. In the oil business, one of the great obstacles to the OPEC members' threats against each other, is the serious effects it has on the market structure and the major oil companies in particular. Even in Libya's case, if the oil companies (all of them majors and independents) would not have agreed to comply with Libya's terms, there would have been a shortage of over 2 mb/d of low-sulphur oil in the world market, which is enough to cause a jump in crude prices.

In an oligopolistic market, there are few producers for the commodity and a large number of buyers competing for it. Wherever this is the case, the producer can easily switch from one buyer to another at any time. Producers are not only able to threaten the buyers, but they should be able to have the same effect on the final consumer.

The oil market is somehow different. It is true that there are few producers of oil, but on the other hand there are few buyers for the commodity. The major oil companies are well known in dealing and refining of crude oils. The country-company relations are very well-functioning, usually on the basis of long-term supply contracts; none of the parties is willing to cut off the long-term relations for temporary reasons. If it happened, it would be a major setback to both parties and might pull other parties into conflict situations. Production violation by an OPEC member probably causes an immediate distribution problem to its buyers, and it may take a long time to channel the crude to its refineries or sell it to others. On the other hand, the increase of crude supply by this member can only be deducted from other member's quotas, causing short-supply problems to their buyers, and so on.

A related tactic is manoeuvering into a *status quo* from which one can be dislodged only by an overt act, an act that precipitates mutual damage because the manoeuvering party has relinquished the power to retreat. In the Libyan example, if the government decided to fulfil its threat for the oil companies rejected to raise posted prices, then both parties would end up at the fulfilment point (L_o,C_o)(see Figure 3.6 below) where both parties would lose. The country's loss being L_oL_1 , and companies' loss C_oC_1 .

In case a threat is made and fails to deter, there is a second stage prior to fulfilment, in which both parties have an interest in undoing the commitment. The purpose of the threat is gone, its deterrence value is zero, and only the commitment exists to motivate fulfilment. This feature has, of course, an analogy with stalemate in ordinary bargaining. Stalemate results from both parties being committed to incompatible positions, or one party mistakenly committing himself to a position that

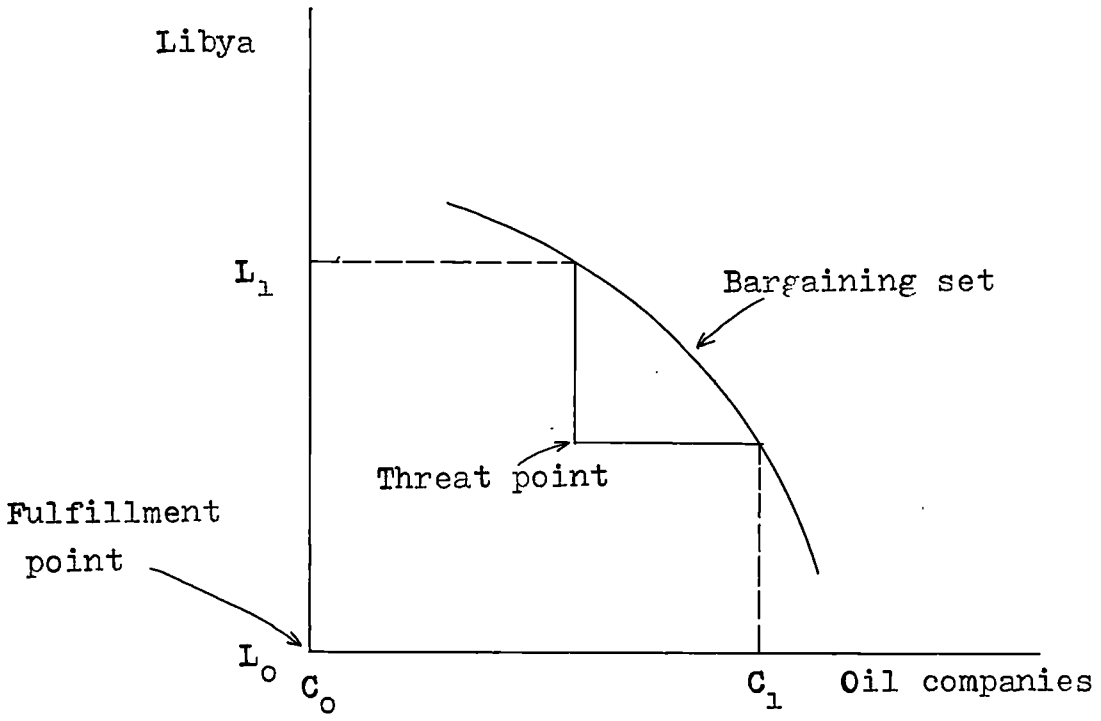


Figure 3.6 Threat and fulfillment points.

the other truly would not accept. If there appears a possibility of undoing the commitment, both parties have an interest in doing so. How to undo it is a matter in which their interests diverge, since different ways of undoing it lead to different outcomes. Furthermore, undoing does not mean neglecting a commitment regardless of reputation (in the case of individuals). Undoing, if the commitment of reputation is real, means disconnecting the threat from one's reputation, perhaps one's own reputation with the threatened person himself. It is therefore a subtle and tenuous situation in which, though both have an interest in undoing the commitment, they may be quite unable to collaborate in undoing it.

Special care may be needed in defining the threat, both the act that is threatened and the counter act that is threatened. The difficulty arises from the fact, just noted, that once the former has been done the incentive to perform the latter has disappeared. The credibility of the threat before the act depends on how visible to the threatened party is the inability of the threatening party to rationalize his way out of his commitment once it has failed its purpose. Any loopholes the threatening party leaves himself, if they are visible to the threatened party, weaken the visible commitment and hence reduce the credibility of the threat.

It is essential, therefore, for maximum credibility, to leave as little room as possible for judgment or discretion in carrying out the threat. If one party is committed to punish a certain type of behavior when it reaches certain limits, but the limits are not carefully and objectively defined, the party threatened will realise that when the time comes to decide whether the threat must be enforced or not, his interest and that of the threatening party will coincide in an attempt to avoid the mutually unpleasant consequences.

So far I have discussed cooperative and non-cooperative solutions within

OPEC, assuming the threat to OPEC can be carried out by any OPEC member against other members. I also showed how a single producing country firmly successfully threatened a group of disunified oil companies. Yet, OPEC stability might be equally threatened by non-OPEC producers, who significantly increased their share of crude production in the last decade at the expense of OPEC's production. This situation resulted from low demand for oil due to the recession and conservation policies, and the choice of OPEC to be a residual supplier in the oil market. In the next section, I will discuss the possible ways in which OPEC stability could be threatened by non-OPEC producers.

3.3 World oil market stability:

It has been argued above that OPEC members are just players in a continuous game. The outcome of the game and hence the stability of their organisation, is very much dependent on the behaviour of its thirteen members. However, the interests of an individual OPEC member, and possibly the cohesion of OPEC as a whole, may well be threatened or enhanced by some or all non-OPEC producers' behaviour. For example, the recent developments in the oil market showed that the oil supply has actually overshot the demand. This meant that some or all world producers had to shoulder the burden of the market by reducing their own production, or face a general reduction in oil prices, or even both, as has been the case since 1983, where the reduction in oil prices was accompanied by OPEC's output reduction.

Thus the link between the community of oil producers (OPEC and non-OPEC) is very strong and cannot be ignored, because market forces do not distinguish between an OPEC member and a non-OPEC member. The 1970s oil prices increases, as will be shown in Chapter 4, is still fresh in their minds. Such increases benefited all world oil producers and not only OPEC

members who actually brought them about. It is true that there can be no OPEC study in isolation from the world oil market, nor a world market assessment without OPEC. The tighteness of oil producers everywhere, necessitates treating them as a group of individual players in a single continuous game. The outcome of the game depends on individual producers' behaviour.

In the past, most of the oil producers have pursued non-cooperative behaviour, considering only their individual interests regardless of the over-all interest of the producers' community. The evidence of this behaviour will be seen below, and offers an explanation of the recent world oil crisis. Yet, the game continues; perhaps at some stage the producers will learn from past experience and agree to a new, more cooperative era.

Cooperation and Non-cooperation behaviour:

It is well known that the famous major seven oil companies controlled the oil market for a long time before and after the creation of OPEC. The power of these companies was destroyed by the growth of their fellow Independent companies in the late 1950s and 1960s, as will be argued later when I discuss the case of Libya in Chapters 5 and 7. I will show how the growth of Independent oil companies and their importance in Libyan oil production has actually eliminated the ability of the Majors to decide for oil producers. The diverse interests between Major and Independent companies among other reasons gave the Libyan Government, in the early 1970s, a clear chance to overcome the companies' bargaining power.

However, it is not surprising if we say that history repeats itself. If we imagine that OPEC is the Major oil companies of the 1950s-1960s and, non-OPEC producers are the Independent oil companies of that time, it becomes easy to understand the present crisis. Since the decline in the world demand for oil in 1980, the self-interests of different world oil

producers have shown themselves, either on the market stability side or otherwise. The producers who were on the stability side (cooperative producers) reduced their production, while the others increased their production despite a decline in world demand for oil. We will see later in this section how this analysis can be explained in terms of game theory. Here we observe , in Table 3.2 below, the major cooperative and non-cooperative producers during (1980-82) period. Up to the end of the period the cooperative producers happened to be OPEC producers. The Table also shows that some of the major oil producers such as the U.S.A., China, Venezuela and Canada, have actually cooperated with the first group, but their contributions were relatively small.

Although the non-cooperation is clear from the Table below, the outcome of the game in this particular period (1980-82), was on the cooperative side. World oil producers managed to reduce their production by over 7 mb/d which was enough to cover the reduction in world demand. But non-cooperative producers, if they continued in their non-cooperative behaviour, would not hurt the cooperative members only but would hurt themselves as well. The missing cooperation between world oil producers is undoubtedly harmful to all of them, especially the new high-cost, low reserves producers.

The oil market problems started with the notion of OPEC being a residual supplier, adjusting with supply-demand imbalances. This concept and the Arab-Israeli War of 1973, which increased oil prices substantially, have encouraged non-OPEC producers not only to search for more oil but to produce as much as they could from the new oil fields, relying on OPEC to keep the prices from falling. Unfortunately there is no easy way for the supply to exceed demand without reductions in prices. OPEC has proved to be unable to play the role of a residual supplier any longer, or at least

Table 3.2

Cooperative and Non-Cooperative World Oil Producers (mb/d)

During 1980-1982

Producer	Increase in production	Decrease in production
(1)Cooperative producers:		
Saudi Arabia		-3.455
Iraq		-1.698
Kuwait		-0.836
Nigeria		-0.770
Libya		-0.699
U.A.E.		-0.491
(2)Other coop.producers:		
Algeria		-0.331
Venezuela		-0.279
Indonesia		-0.240
Canada		-0.180
Qatar		-0.145
China		-0.076
U.S.A.		-0.059
(3)Non-coop. producres:		
Mexico	+0.868	
Iran	+0.510	
U.K	+0.469	
USSR	+0.201	
Total	+2.048	-9.259
Balance		-7.211

Source: Calculated from *Petroleum Economist*, [Sept.1983], p.368.

not sufficiently. Oil producers have found themselves unwillingly reducing the oil prices and they may continue to do so, assuming the demand stays low, unless they adjust their production to the demand level.

Since its creation up till now, OPEC has been increasing or decreasing its crude oil production to balance the world supply-demand situation, thus playing the role of the world's residual oil supplier. Some writers went as far as to say "*if there have been no OPEC, there would have been greater fluctuations in oil prices, with adverse consequences on the world economy*" [Samii 1984 p.9]. This role of OPEC is shown in Table 3.3 below through the relationships between world demand, OPEC supply and non-OPEC supply.

Table 3.3

World Demand for Oil and OPEC and Non-OPEC Supplies

1973-83 (mb/d)

Year	World demand*	OPEC supply	Non-OPEC supply
1973	41	31	17
1974	46.5	30	16.5
1975	43	28	15
1976	44	30	14
1977	50	33	17
1978	48.5	29.5	19
1979	**51**	**30.5**	**20.5**
1980	**46**	**27.5**	**21.5**
1981	**46**	**23.5**	**22.5**
1982	**41**	**18**	**23**
1983	**39**	**14****	**26****

(*) Including stocks.

(**) Estimates.

Source: *OPEC Bulletin*, March 1984, p.18.

During the 1970s, whilst producing oil close to its maximum sustainable capacity, OPEC was constantly under pressure to raise both output and production capacity in view of expected increases in oil demand, both in the industrial and in the developing countries. The increase in world demand from 41 mb/d in 1973 to 50 mb/d in 1977 was actually met by OPEC's increased production, while non-OPEC supply was at the same level as in 1973 (17 mb/d). This positive role of OPEC as a residual supplier is illustrated in Figure (3.7-a) below. If OPEC had not balanced the supply-demand equation in 1977, the oil price would have been higher as indicated in Figure (3.7-b). The price would have increased from P_o to P_1.

Figure (3.7-a)

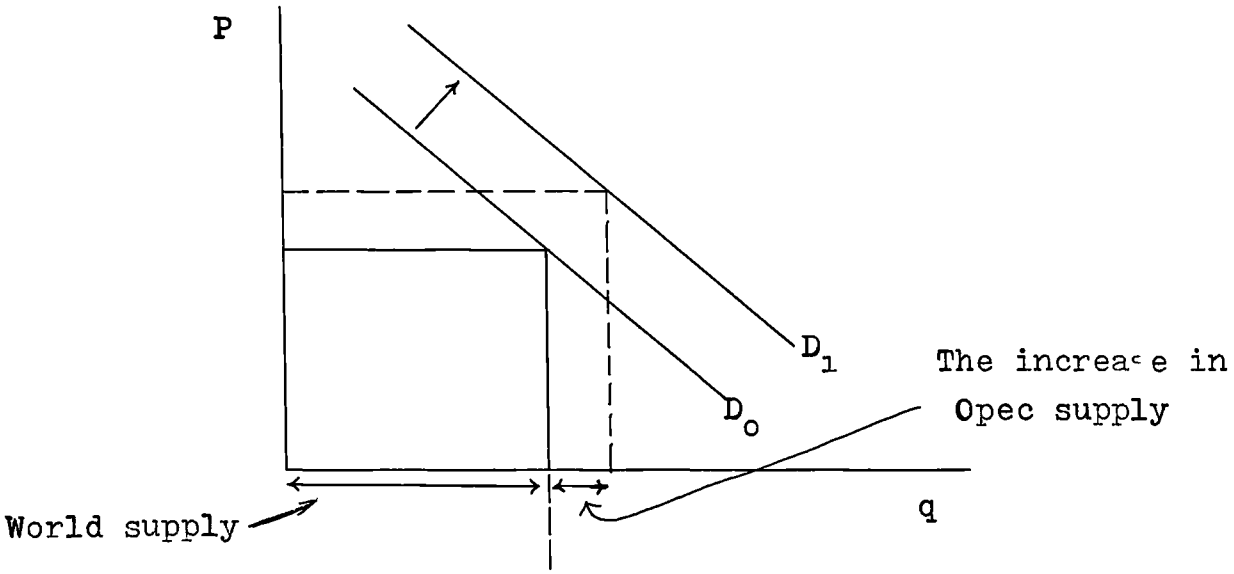
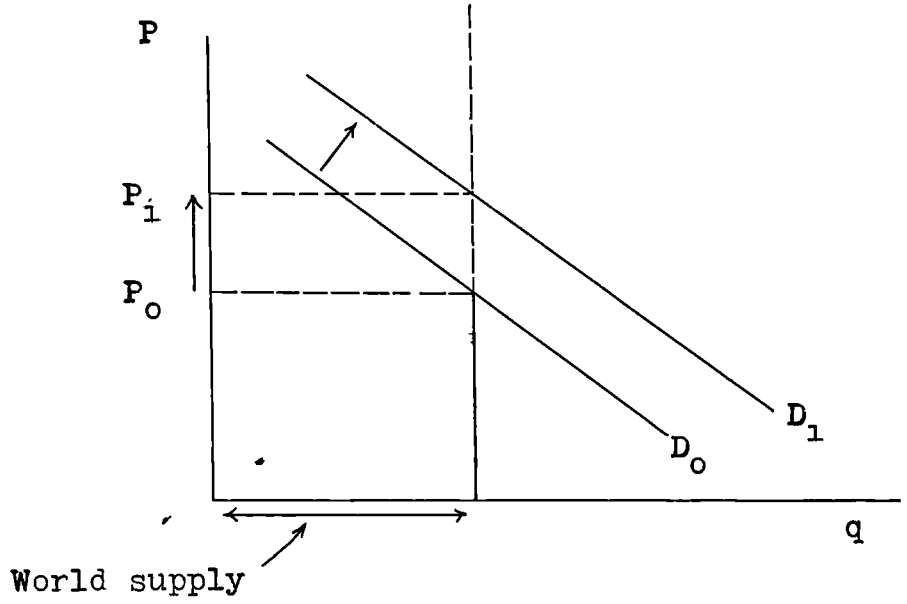


Figure (3.7-b)



Most forecasts indicated that there would be a need by the mid-1980s for an OPEC production level far above its actual sustainable capacity. Some studies have projected Saudi production alone to increase to extremely high levels, to 16.6 mb/d [Franssen 1978 p.50] according to "*World Oil*", or even 23 mb/d according to "*U.S.CIA*" [April 1977 p.18]. These studies assume that because Saudi Arabia has traditionally played, as an OPEC member, the role of a residual supplier, and since the other members will not be able or willing to increase oil production significantly, Saudi Arabia will continue to do so. They also based these assumptions on expressed Saudi concern regarding the well-being of the Western economic and political system [Murshid 1980].

Table 3.4 shows that the difference between the lowest and the highest levels of Saudi daily oil exports varies significantly from month to month.

Table 3.4

Saudi Arabian Oil Exports in 1978

Month	Aramco	AOC	Getty	Total
Jan.	6.847	0.074	0.040	6.962
Feb.	7.470	0.089	0.051	7.610
Mar.	6.653	0.118	0.041	6.812
Apr.	7.470	0.143	0.019	7.632
May.	6.625	0.061	0.037	6.723
June	6.777	0.110	0.048	6.935
July	6.594	0.106	0.047	6.747
Aug.	6.795	0.146	0.015	6.956
Sept.	7.359	0.165	0.049	7.573
Oct.	8.605	0.219	0.059	8.883
Nov.	9.378	0.222	0.046	9.646
Dec.	9.736	0.236	0.059	10.031
1978	7.524	0.141	0.042	7.707
1977	8.512	0.079	0.061	8.657
% Change	-11.7	79.9	-30.4	-11.0

Source: *Middle East Economic Survey*, January 22, 1979.

For example, in May 1978, average daily exports were just over 6.723 mb/d, while in December of the same year, average daily exports reached 10.031 mb/d to reduce the effect of an oil shortage. The difference between the highest and the lowest export levels was 3.3 mb/d, a level which approximates the production level of the second largest OPEC producer. The oil glut which plagued OPEC countries during late 1977 and early 1978 and which was estimated to have reached a peak of 2.5 mb/d [OPEC Bulletin May 15, 1978] was quickly and significantly reduced to 1.0 mb/d

and was later eliminated mainly as a result of the Saudi production cutback, though a few months later an oil shortage developed as a result of significant reductions in Iranian oil exports due to the political events in the country at that time.

The Saudi position is influenced by political rather than economic reasons. Some have suggested that Saudi Arabia took its position against major oil price increases because it possesses large oil reserves and it fears that oil price increases will lead to the rapid development of alternative energy sources. Thus in the long-run, Saudi Arabia will not be able to maximize the revenues it receives for its oil.

In my view the Saudi position is influenced by the following factors. Saudi Arabia wishes not to disrupt or destabilise the Western economic and political system, because the consequences would also affect Saudi Arabia. If the price of oil increases to significantly higher levels, some of the other OPEC members might be encouraged to reduce their oil production as their revenue requirements would be satisfied by lower production levels, thus creating a shortage of oil supplies which would, in turn, put pressure on Saudi Arabia to increase its already higher than preferred production. Another factor is that the Saudis have a great interest in maintaining the unity of OPEC. This desire makes it necessary for Saudi Arabia to yield, every now and then, to the mounting pressure from other OPEC members to increase the price of oil. The Saudi position is also influenced by the hope that a policy of moderation will encourage the West, especially the United States, to work towards a permanent solution of the Arab-Israeli dispute.

Saudi Arabia acquired its tremendous power and has been able to play a major role in OPEC and exert influence over the world market because of the huge oil reserves it possesses, because of its large production and excess

production capacity, and because of its large surplus revenues. Its large oil reserves have enabled the country to produce large volumes of oil and rank as the world's second largest oil producer after the Soviet Union. The size of its oil reserves also made it possible for Saudi Arabia to have a large excess production capacity which it can use during seasonal or temporary shortages in oil supplies. Finally, because of its large surplus oil revenues, Saudi Arabia can afford to reduce its oil production drastically without suffering any economic hardship.

Since 1980, however, the situation has been reversed. In the last few years there has been a substantial decline in world demand for oil. The fall in the demand for oil has been brought about by a number of well-known factors such as;

(1) Recession in the United States and other industrial countries.

(2) Energy saving.

(3) Interfuel substitution.

(4) Stock drawdown (this can be derived from Table 3.3 above).

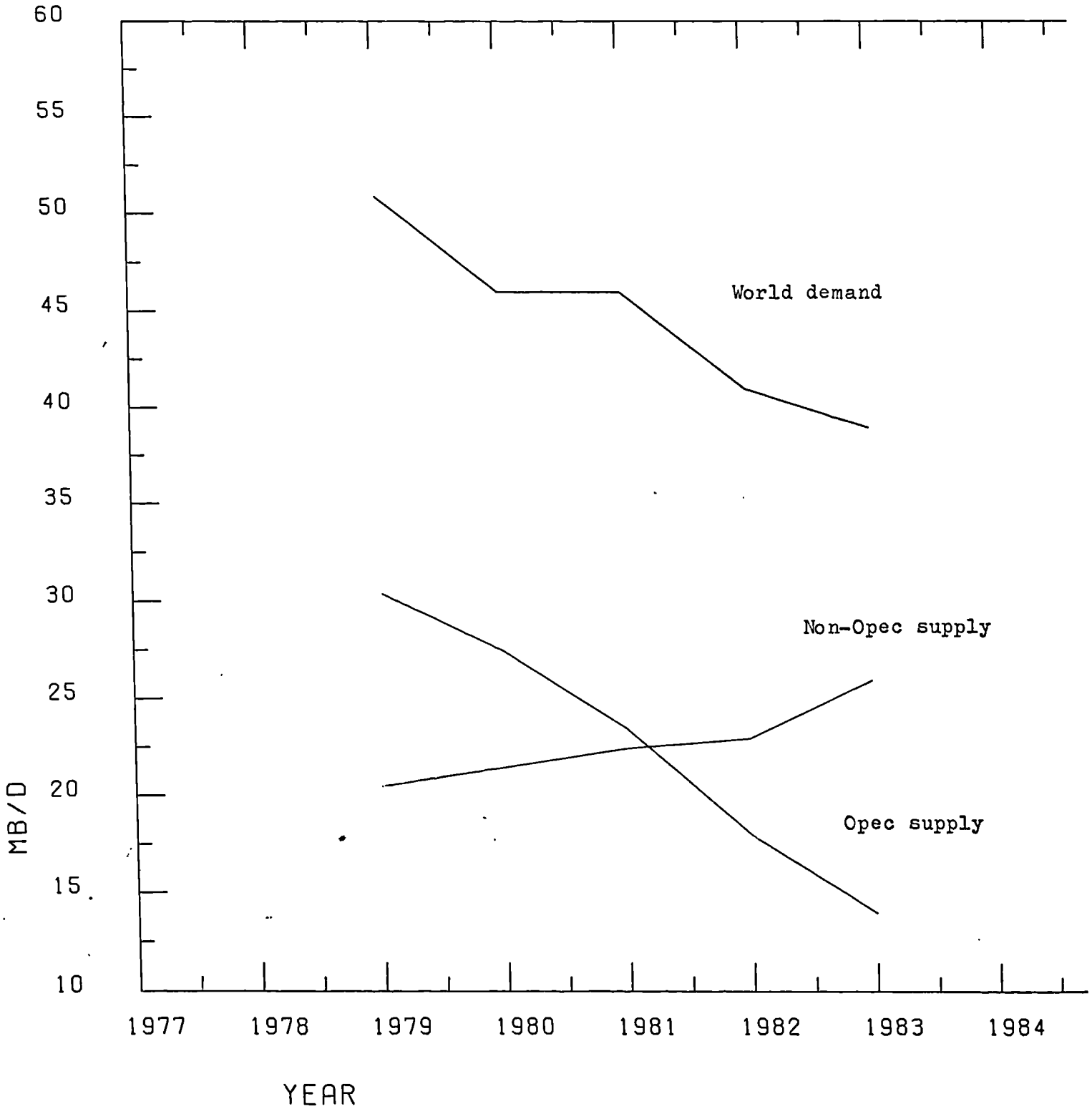
(5) The increase in non-OPEC supply.

These points and, in particular, the latter point which is in the hands of oil producers, have had a significant effect on oil prices. The non-OPEC supply increased from 20.5 mb/d (40.2% of world demand) in 1979 to 26 mb/d in 1983, (66.7% of total demand), while OPEC supply decreased from 30.5 mb/d (59.8%), in 1979 to about 14 mb/d (35.9%) only in 1983. This is shown in Figure 3.8 below.

The decrease in world demand was, in fact, shouldered by OPEC members and not by the rest of world's producers. OPEC supply reduced by 23.8% during the period (1979-1983) showing no doubt the intention of its members to cooperate in order to satisfy the producers' interests. On the other hand, a number of the non-OPEC producers have not only departed from cooperation

FIGURE 3.8

World oil demand, Opec and Non-Opec supply



with OPEC but insisted on non-cooperation behaviour by increasing their own production despite the decline in the world demand. This opposes their individual self-interests, as well as the interests of the world producing community. R. Mabro [1985] in a recent article about BNOC, rightly says "*The UK is not being asked to help OPEC but to look after its own self-interest which may, at times, coincide with that of other oil exporting countries*".

Figure 3.9 below illustrates an approximate mechanism of oil supply and demand. It shows both supply and demand curves have shifted to the left indicating the decline in supply and demand. For non-cooperation reasons, just mentioned above, the demand shifted more than the supply did, causing a glut in oil market and consequently, in 1983-4, prices were forced to decline as shown in Figure 3.9 by the move from high price P_o to low price P_1.

The Figure illustrates a non-cooperative case resulting from non-cooperative behaviour. The world oil producers (OPEC and Non-OPEC) have no doubt been faced with reductions in their payoffs (or revenues). It is clear from Figure 3.9 that $OP_oNq_o > OP_1Mq_1$.

In terms of game theory we may assume that world oil producers according to their individual choices are divided into two groups, even though the aim or the payoff for any producer is to maximize the total oil revenues. They only differ on how to achieve such a goal. These two groups are:

(A) World oil producers who are actually willing to increase their revenues, but not at reduced oil prices. I call this group "*Cooperative producers*". They are mostly OPEC producers.

(B) World oil producers who are also willing to increase their revenues by any means. They clearly do not care much, in the short-run at least, whether the price of oil is rising or falling. I call this group

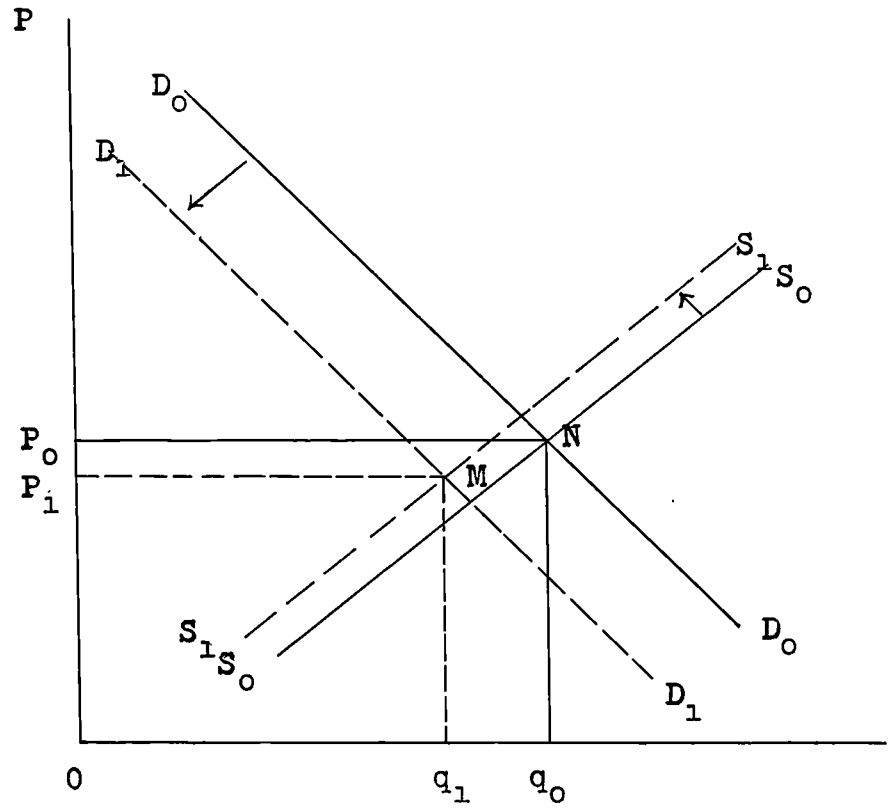


Figure 3.9 World supply and demand for oil.

"*Non-cooperative producers*".

Since oil prices are determined by the market forces of supply and demand rather than by an individual producer, all an individual producer can do is to fix his own production level according to his prefered strategy. The strategies open to both parties are as follows:

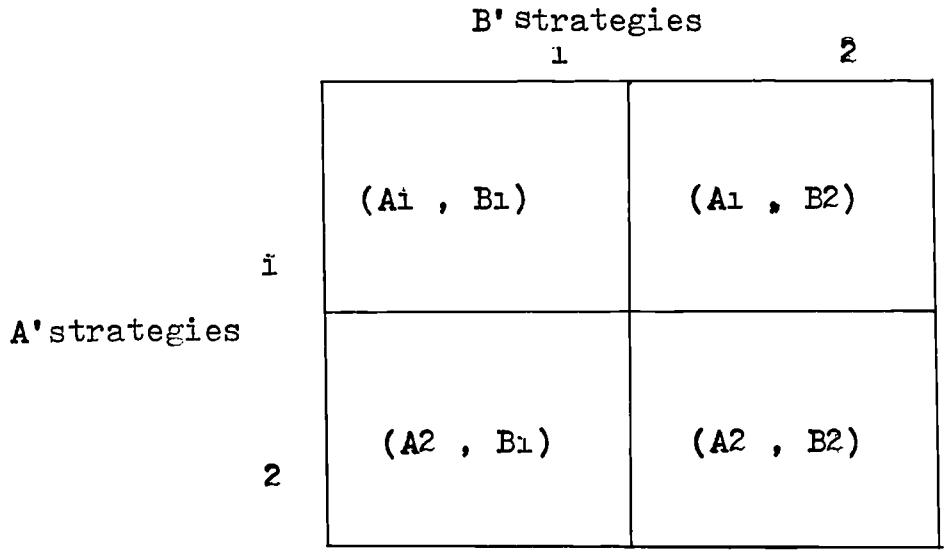
(1) Reduce oil production.

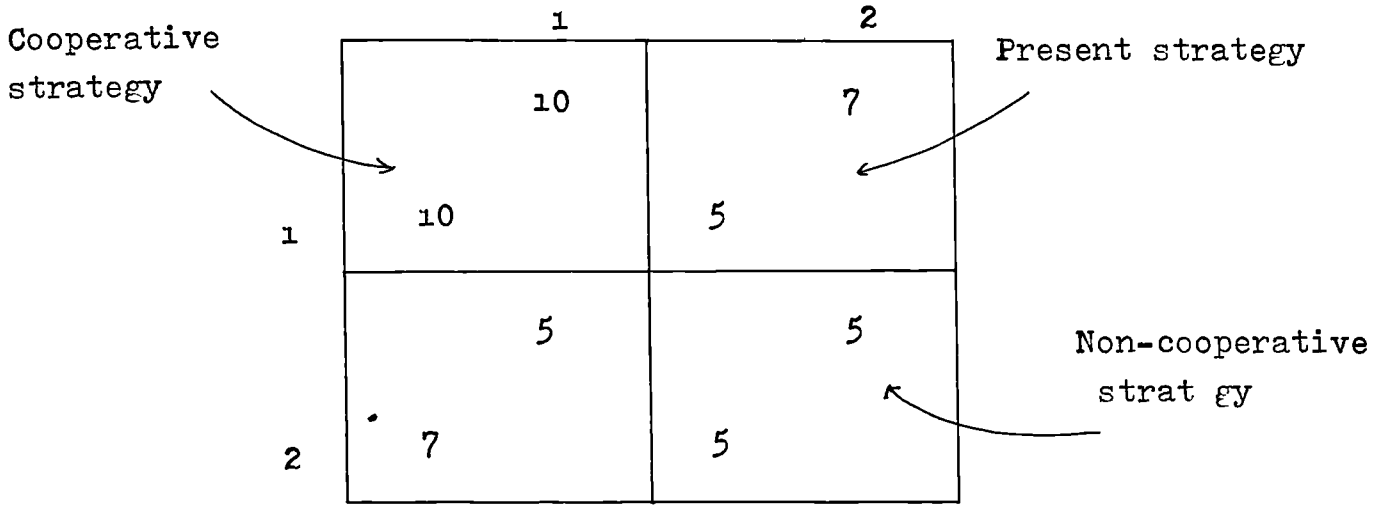
(2) Increase oil production.

If both parties (A , B) choose their first strategy (1) by reducing their production, this would mean that the total world supply of oil, which is equal to both parties production, would decline. Such a decline in the supply, at a constant demand level, may well lead to a rise in oil prices. This eventually leads to an increase in oil revenues and the value of oil reserves. I call this strategy "*cooperative strategy*", (A1,B1) or (10,10) in the matrix below.

The rise of OPEC and its role as a residual supplier (discussed above), have to some extent given a reason to some other non-OPEC producers to rely on the organisation to make the necessary adjustments for the total world supply and demand. For this reason, and for national reasons such as the security of domestic needs from energy, they may decide on strategy (2) by increasing their production. By doing this they hope that the cooperative producers, especially OPEC and Saudi Arabia in particular, would accommodate such an action by reducing their own production (strategy 1). Thus, strategy (A1,B1) or (10,10) is freely eliminated.

The second party "*cooperative producers*", especially Saudi Arabia, from their point of view as the largest oil reserves holders would not actually employ their strategy (2), for that would result in a reduction in oil revenues as well as the value of their reserves due to the reduction in oil prices. They also might fear to lose the prestige of being the leaders of


B' strategies
1
2
A' strategies
1
2
(Ai , Bi)
(Ai , B2)
(A2 , Bi)
(A2 , B2)


Cooperative strategy
Present strategy
Non-cooperative strat gy
1
2
10
7
10
5
5
5
7
5

the oil market if they do. This peculiarity concerns OPEC producers more than other cooperative producers. The increase in production might result in a reduction in prices and destruction of the Cartel. Thus, strategy (A2,B2) or (5,5) in the matrix above also cannot be employed. The only strategy open to both parties, and that is actually the state of the oil market at the present time, is strategy (A1,B2) or (5,7) above. This strategy clearly favours the non-cooperative producers for they obtain 7 units of utility, while the cooperative producers obtain 5 units only.

The above assessment very much represents the position of the oil market at the time of writing (1985) and will hold in the near future unless the demand for oil falls substantially, so as to force the cooperative producers to choose their strategy two (increase in production) in order to meet their domestic financial requirements. In this case the world producers would end up with a non-cooperative solution (A2,B2) or (5,5). The economic and political chaos is likely to be high in all oil producing countries, especially high-cost oil producers. The other possibility is that the price of oil gets so low as to make the non-cooperative producers realise that they are losing in terms of the value of their resource more than they actually gain in terms of the volume of production in comparison to other producers. This could happen before or after the collapse of OPEC, depending upon how long the non-cooperative producers are prepared to wait and how much the cooperative producers could resist such a decline in prices. Thus, the non-cooperative producers may choose their strategy one (reduce oil production), and in this case the world oil producers would end up with a cooperative solution (A1,B1) or (10,10) above.

However, to be optimistic, producers may at any stage realise that the past has already gone and what is lost because of non-cooperation can only be compensated by a new look to world production relationships. The

cooperation between world oil producers is the clear and the only way out of the producers' dilemma, with or without OPEC.

In this chapter I have reviewed the early attempts at modelling OPEC behaviour. I showed that the Hnyilicza and Pindyck model has offered a useful insight into the use of the cooperative side of game theory in the assessment of OPEC behaviour. My attempt to analyse OPEC behaviour showed that the members effectively behave as real persons, according to their own self-interests. But on the other hand I suggested that a number of these producers actually do care about the collective interests of the group. This is evident from the use of tacit accommodation. However, the selfish members of OPEC are not the only force against the interests of the organisation, but a number of the non-OPEC producers are also exerting some pressure. Oil market stability, and therefore OPEC stability is no doubt subject not only to a single or a small number of producers' actions, but also to a wide range of individual oil producers' preferences. But for sure the more the cooperation there is between these individual producers, the better for the majority of individuals and for the producing community as a whole.

In the next chapter I will show how some of the world producers, OPEC producers, managed to cooperate in order to satisfy their interests and the interests of their fellow oil producers.

CHAPTER 4: OPEC STRUCTURE AND FORMULATION

In the previous Chapter I analysed the present dilemma of OPEC members. It has been argued that the only way OPEC could solve or at least reduce the scale of its dilemma is through cooperative behaviour where each member tries to fulfil the Organisation's interests hoping to increase his own payoff. This process implies that the more the individual members cooperate, the more likely is OPEC to be stable . The best position the members can obtain is with complete cooperation.

In this Chapter I analyse the way in which OPEC became the dominant power in the world oil market. I will show how the scattered third world oil exporting countries over the years managed to form and sustain the most successful cartel of the present time.

In my view the rise of OPEC is the result of its struggle to get a fair share of profits from the oil business. The oil exporting countries, long ago before the formation of OPEC in 1960, were driven to follow a number of strategies to achieve such success. These can be summarized as follows:

(1) The improvement of royalties and taxes on income, leaving the extraction and marketing of crude oil in the hands of the international companies.

(2) The formation of national oil companies for extracting and marketing oil.

In the early years of oil production in the Middle East, the producing countries such as Saudi Arabia, Iran, Iraq and Kuwait would not know whether the 4 Shillings a ton given to them by oil companies was the appropriate economic rent. However, currency fluctuations and continuous inflation reduced the governments revenues. This, in fact, marked the beginning of dialogue between the governments and the companies. The

former requested the latter to increase the payments to the governments concerned. Next, the host countries had to impose taxes on profits from oil, but this required knowledge of company accounts. Having solved these problems, the other steps such as profit sharing, participation and nationalisation followed from the fact that every sovereign nation in the world has the right to establish control and management of its resources.

This chapter assesses the efforts of oil exporting countries, and the circumstances in which they had to work, in order to obtain a share of oil profits at first, and later the domination of crude oil production. Such events led to a firm control of upstream operations, exploration, production, marketing and pricing, which in turn provided the natural base for downstream operations, such as refining, gas treatment and petrochemical industries.

4.1 Fixed royalty and taxes on profits:

Prior to the Second World War, royalty payments to Iraqi and Iranian governments were settled on an annual royalty of 4 Shillings (gold) per ton on oil sold locally or exported regardless of the oil prices. In the late 1930s, the royalty was equivalent to about 20-22 cents per barrel, where the price was just over one dollar. Strictly speaking this is a fixed royalty which has no relation to oil prices.

The problem of exporting countries is that the increase in oil prices would reduce the royalty ratio (royalty per ton/price per ton) and a general inflation reduces the real value of royalty per ton. This means a reduction in the economic rent to oil producing countries and an increase in the profits to oil companies. The producing countries efforts to solve this problem will be discussed later.

Meanwhile, the terms of the payment in the concession agreements granted by the three States, Kuwait, Bahrain, and Qatar in 1913, 1914 and 1916

respectively, did not differ substantially from those of Iraq and Saudi Arabia, except in one respect; royalty payments were fixed in terms of rupees, not gold shillings. In Bahrain, the 1925 agreements provided for a royalty payment of 3.5 rupees per ton of crude oil (Article 8). The course of events was similar in Kuwait. In the 1934 agreement, royalty payment was fixed at 3 rupees per ton of crude oil plus a quarter of a rupee in lieu of taxes; this was equivalent to 16 cents a barrel. Similarly, in Qatar the agreement of 1935 with the Anglo-Iranian Oil Company stipulated a royalty payment of 3 rupees per ton of crude oil.

These agreements, which were granted in local currencies instead of gold Shillings, proved to be insignificant for these States. For example, in Bahrain the devaluation of the rupee reduced Bahrain's royalty from 17 cents per barrel in 1930 to 12 cents in 1931. The royalty recovered to reach 18 cents per barrel after the devaluation of the dollar in 1934, but once more dropped to 10 cents per barrel after the second devaluation of the rupee in 1949. Similar fluctuations were experienced by Kuwait and Qatar as shown in Table 4.1 below.

Table 4.1

Fixed nominal royalty(equivalent in $)in Bahrain,Kuwait and Qatar

(1934 , 1949)

Country-Year	1934	1949
Bahrain (3.5 rupees)	0.18	0.10
Kuwait (3.25 rupees)	0.16	0.09
Qatar (3 rupees)	0.14	0.08

Source: Issawi and Yeganeh [1962], p.131.

During and immediately after the Second War, new factors arose that led the sovereign crude exporting countries in the Middle East to express dissatisfaction with existing agreements and to press for higher payments.

First, there was the sharp inflation experienced by the Middle East during the War. In Iraq and Iran the cost of living index rose from 100 in 1939 to 558 in Iraq in 1948 and 639 in Iran, after the devaluation of the Rial by 50% in 1941. This rise in prices, beside the increase in prices of imported goods, greatly reduced the real value of payments to the governments. The situation had been worsened by the increase in imported goods prices.

Second, there was the rise in the price of petroleum, which had more than doubled between 1939 and 1948. Since payments to the governments continued to be made on a fixed royalty basis, this reduced the share of the governments in the value of the oil produced. Thus, in a memorandum presented by the Iranian government to the Anglo-Iranian Oil Company in August, 1948, the following statement was made: "*Royalty basis: the Figure of four shillings a ton represented one-eighth of the price of Persian crude oil, whereas now, on the basis of gold, it is according to the company's accounts less than one-sixteenth. Thus the total of the Persian government's royalties in relation to the total price of oil extracted represented 33 % in 1933 and only 9 % in 1947*" [Elwell-Sutton 1955 p.168].

Thus, for the reasons discussed above, the exporting countries were unsatisfied with the existing agreements.

Now, as I mentioned above, the aim of oil exporting countries was to obtain the economic rent available through the exploitation of crude oil. The maximization of such rent required a knowledge of:

(a) The demand conditions for crude oil.

(b) The profits of the oil companies.

Since the exporting countries did not actually produce, sell or price oil, their knowledge about the whole petroleum business was limited. In contrast the producing oil companies, which actually ran the industry, had

not only knowledge of their own affairs but knowledge of the oil market. For oil exporting countries to confront the oil companies, they had to solve the problem of the lack of information in comparison with the wide knowledge of the oil companies. This position might be expressed as an asymmetric information problem.

According to the "*rational expectation school*", adaptive expectations do not use all of the information available on the functioning of an economy and are therefore not rational [Cukierman 1984 p.1]. Recognition of this has forced modern macroeconomic model builders to specify more carefully who knows what, and when, and to formulate mechanisms for forming expectations that are consistent with this information structure.

For the purpose of this Chapter it is important to stress who knows what and when. The pre-OPEC oil market used to be the private property of the international oil companies; they knew what quantities of crude they produced, where to market them, and what price and profit levels they obtained, and above all when to do that. In a sense, they were like states within states. The oil exporting countries had been no more than generous hosts. The actual and expected production, prices and profits had to be formulated in their absence, or more sympathetically, without their knowledge. At this stage there had been no game the host countries could have possibly played with oil companies. Because of the lack of information available to them about their own oil, they could not measure the extent of their rights. In terms of game theory, the negotiation set was not clear to them, neither was the threat point. In fact asymmetric information made the whole oil business look like as if it was in an equilibrium situation. Later in this chapter I will show how the exporting countries managed to change this situation by moving into profit-sharing agreements, and later on to participation in the ownership of the oil

companies themselves, and in many cases complete nationalisation.

However, what the exporting countries lacked at the beginning was information about the whole business, especially information related to the calculations of prices and profits. The events that followed in Venezuela and the Middle East had served as signals to the exporting countries of the unfair country-company relationships. The countries soon realized that they had to move away from the so called "*fixed royalty*", discussed above, to a new Iranian-Venezuelan formula of profit sharing. The following events had led to more radical changes concerning the exporting countries' share of profits accruing from crude production.

First, there was the introduction in Venezuela of the Law of Hydrocarbons of 1943 and of the Additional Tax of 1948, which resulted in the increase of the government's share to at least 50 % of the net income of the oil companies. This introduced a new and, to producing countries, far more attractive pattern to the oil industry.

Second, there was the tentative agreement in April 1946 between the Soviet Union and the Iranian government for a Soviet-Iranian oil company in the Northern provinces of Iran. This was part of the Iranian-Soviet negotiations that resulted in the evacuation of Soviet troops from Iran [Kirk 1954]. Under this project, Iran would supply the oil resources and receive 49 % of the shares, and the Soviet Union would supply the capital and technical skills, receiving 51 % of the shares. After 25 years the shares would be changed to 50-50 for another 25 years; profits would be divided proportionately to shares. Although the agreement was vague regarding marketing and pricing, it had a certain attraction, especially when compared to other existing concessions. Nevertheless, in 1947 the Iranian Majlis (Parliament) rejected the Soviet offer on political grounds. However, oil companies offered Iran the Supplemental Agreement on 17 July

1949, which raised the royalty rate from 4s. to 6s.(gold) and provided for immediate payment of Iran's share in profits. This agreement was signed by the Iranian government although it had been pressing for a 50-50 profit sharing agreement but, after long debate, the Majlis refused to ratify it. A further offer, made by the company in February 1951, and embodying an arrangement for equal sharing of profits, came too late to prevent the passing of a law in March that nationalized the oil industry, and the crisis that followed.

The third factor that encouraged the governments to ask for better terms was the concession agreements for the Saudi-Kuwait Neutral Zone concluded in 1948 and 1949. The agreements contained new favourable terms for producers, as shown in Table 4.2 below.

Table 4.2

Saudi-Kuwait Neutral Zone Oil Agreements: 1948-49

Date	Bonus($m)	Royalty(c per barrel)	Carried out interest(%)
6 June 1948	7.5	34	15
20 Feb. 1949	9.5	55	25

The arrangement between Kuwait and the American Independent Oil Company of 6 June 1948 (Article 3), provided for a bonus of $7.5 million in cash, a royalty of $2.50 a ton or about 34 cents per barrel, and a 15 % "*carried interest*" or share of the net profits. The agreement of 20 February 1949, between Saudi Arabia and the Pacific Western Oil Corporation (Articles 5-7) provided, even better terms; a bonus of $9.5 million, a royalty of 55 cents per barrel, and a 25 % "*carried interest*".

The pattern for this period was set by the agreement between Saudi Arabia and the Aramco of 30 December 1950, which followed the promulgation of income tax decrees on 4 November 1950, and 27 December 1950, providing, among other things, for the taxation of business profits. The agreement

accepted the principle of equal sharing of profits by stipulating, in Article 1: "*In no case shall the total of such taxes and all other taxes, royalties, rentals and exactions of the government for any year exceed fifty per cent (50%) of the gross income of Aramco, after such gross income has been reduced by Aramco's cost of operation, including losses and depreciation, and by income taxes, if any, payable to any foreign country but not reduced by any taxes, royalties, rentals or other exactions of the government for such year*".

An important modification was introduced the following year, On 2 October 1951, when it was stipulated that the Saudi Arabian government's 50 % share was to be calculated before the deduction of foreign (i.e. United States) income taxes. Similar profit-sharing agreements, arising from the sale of crude oil to foreign companies, were adopted as shown in Table 4.3 below. In Kuwait on 3 December 1951, in Iraq on 3 February 1952, in Qatar on 1 September 1952, in Bahrein in September 1952, and in Iran, after the settlement of the nationalisation dispute, on 19 September 1954.

Table 4.3

Middle East Profit-sharing Agreements: 1950-54

Country	Date of agreement
S. Arabia	30 Dec. 1950
Kuwait	3 Dec. 1951
Iraq *	3 Feb. 1952
Qatar	1 Sep. 1952
Bahrein	15 Sep. 1952
Iran	19 Sep. 1954

Source: Issawi and Yeganeh [1962], p.134.

As a result of these developments, the per barrel take of the oil exporting governments increased from as low as 8 cents in Kuwait and Qatar

in 1950 to reach 50% of total profits in all countries by 1956, as shown in Table 4.4. The progress of the exporting countries at this stage can be seen clearly from the last column of the Table, where the government take increased from about 4.5% of the price, in Qatar, in 1950 to as high as 46.88%, in Kuwait, in the period 1957-59.

The main issues raised by sharing of profits from the extraction and sale of crude oil are:

(a) The price of crude oil.

(b) Deductions from revenues to arrive at the profit figure.

In order to determine the share of governments from oil income under the equal profit-sharing agreements, it is necessary to deduct from the value of crude oil exported or delivered to local refineries the cost of crude oil production. Some of the agreements, like those with Saudi Arabia and Iran, provide for deduction of actual cost of production, while some others, like those with Iraq and Qatar, specify an agreed sum as the cost of crude output, subject to adjustment in case the actual cost differs from the agreed cost by a certain specified percentage. The governments were given the right to check the accounts of the oil companies and verify costs. As to the coverage of costs, they usually included, in addition to the fixed and variable costs attributable to production of oil, certain exploration and drilling outlays. The difference between the value of crude oil and its cost of production, which is defined as income of oil operations, is shared equally by oil companies and governments. Actually, irrespective of the amount of such income, the governments receive royalties, rentals, and other fixed taxes, but in determining their 50 % share from income, such payments are taken into account and the balance is paid in lieu of income tax [Penrose 1968 p.64].

Since its creation, in September 1960, OPEC took the view that royalties

Table 4.4

Oil Prices and Payments to Producing Governments($/b)

(1946-59)

Country&period	Payments to govers. (1)	Companies' income (2)	Crude price (3)	1/3* ratio
1.Bahrein				
1946	0.15	0.93	1.18	12.71
1951	0.28	1.30	1.68	16.67
1957-59	0.80	0.80	1.75	45.71
2.Iran				
1956-58	0.78	0.78	1.80	43.33
3.Iraq(Tapline)				
1949	0.22	1.43	2.10	10.48
1953	0.75	1.01	2.00	37.50
1955-56	0.90	0.90	2.00	45.00
4.Kuwait				
1950-51	0.08	1.28	1.47	5.44
1957-59	0.75	0.75	1.60	46.88
5.Qatar				
1950	0.08	1.34	1.77	4.52
1957-59	0.87	0.87	2.02	43.07
6.Saudi Arabia				
1946	0.22	0.77	1.18	18.64
1951	0.56	0.92	1.68	33.33
1956	0.78	0.78	1.87	41.71

(*) (Government take/Price) ratio.

Source: Issawi and Yeganeh [1962], p.117.

should be considered payments to the owners of resources in return for removing the oil and that royalties should be included as part of the cost of production. Thus governments should receive royalties plus 50% of gross income. This matter and others concerning OPEC's share in crude profits will be discussed next.

4.2 OPEC and Profit sharing:

At the time OPEC was created, royalty payments to host governments were in the form of royalty per barrel, usually 12.5 % of the posted price, except in Venezuela where the rate of 16 2/3 % was used. When the companies agreed on the 50-50 profit-sharing formula in the early 1950s they calculated the royalties as part of the government's 50 per cent. For example, at a posted price for crude of $1.80 per barrel with a 12.5 % royalty (the equivalent of $0.225 per barrel) and allowed production cost of $0.20 per barrel, the government "take" share would be (50-50 profit) calculated as follows: Royalty is credited against income tax: the sum due for one barrel is $1.80 minus $0.20= $1.60. Thus the government share is $0.80. This formula made the government's actual share much less than adding royalty to the production cost and then dividing profits equally between government and company. In this case royalty is treated like other costs of production: the sum due for one barrel is $1.80-$0.20-$0.225 (royalty)=$1.375; government share is $0.6875 (based on 50-50 profit-sharing). Total government revenue will be $0.6875 (income tax) plus $0.225 (royalty)=$0.9125 [Al-Sowayegh 1984 p.48]. The royalty, in effect, became a payment to the companies rather than the countries. In the words of Rouhani, OPEC's chief negotiator with oil companies "*Either the companies are paying income tax at the full rate prescribed by law, but no royalties, or they are effectively paying royalty but their income tax payment amounted to about 41% of income, not 50%*" [Mughrabey 1968 p.141].

Against the foregoing background, Resolution 33, adopted at OPEC's Fourth Conference in Geneva in 1962, demanded that each member country affected should approach the company or companies concerned with a view to working out a formula under which royalty should be fixed at a uniform rate that members considered equitable, and should not be treated as a credit against income tax liability. However, approaching the companies to discuss the issue of royalties was not an easy task. The negotiations on this issue lasted form 1962 to 1965, and have been characterized by OPEC as the longest, toughest and most revealing negotiations in the history of the international oil industry. Throughout the negotiations the oil companies persistently rejected the principle of collective bargaining, which OPEC countries adopted to deal with the companies. This principle, as will be seen in Chapter 7, has been reversed. The oil companies in their message to OPEC in January 1971 proposed a collective bargaining principle with OPEC. Although two or more of the companies were joint owners of concessions in each of the Middle Eastern exporting countries, and were accustomed to using their collective power in negotiating with individual countries, they were reluctant to recognize and accord a similar joint interest to the countries with which they dealt.

Eventually the companies reluctantly agreed to bargain with OPEC. The protracted negotiations ended in the companies agreeing to improve the royalties of the oil-producing countries. In other words, royalties were to be deducted before profits were calculated and divided, thus increasing the actual government "take" per barrel of crude. However, the royalty settlement permitted the companies to discount the posted prices by 8.5% in 1964, 7.5% in 1965, and 6.4% in 1966, in calculating their income tax obligations [Rouhani 1971 p.228]. The posted price for deduction purposes had to be set at a lower level than the original posted price by the amount

equal to the rate of discount allowance. The settlement provided for consultation in 1966 between the governments and the companies on possible future reductions in the discount rate. In April 1966, at OPEC's Eleventh Conference in Vienna, the member states adopted Resolution X171, advising member countries to take steps towards the complete elimination of the discount allowance granted to the oil companies.

In accordance with this recommendation, negotiations soon reopened between the producing countries and the companies. However, as usual negotiations proved difficult, and there was no solution in sight when the Arab-Israeli war broke out in 1967. Following the outbreak of war, the Arab countries decided to boycott oil shipments to certain countries; the boycott, together with the closure of the Suez Canal, caused crude oil prices to recover. The interruption of oil supplies and the firming of the oil market improved OPEC's bargaining position. At the OPEC Conference in Rome in September 1967, the members decided that the five countries most concerned with expanding royalties (Saudi Arabia, Iran, Kuwait, Libya and Qatar) should meet for consultation on the issue in early October. On 9 January 1968, after a two-day conference in Beirut, the five OPEC members announced that they had accepted an offer by the companies on 6 January to Iran and Saudi Arabia, binding all companies operating in OPEC member countries. Under the agreement reached, the discounts were to be phased out over a four-year period, declining from 5.5% in 1968, to 4.5% in 1969, 3.5% in 1970, 2% in 1971,and ceasing entirely in 1972.

So far I have been discussing the problem of profit sharing between crude producing countries and oil companies. This issue was coupled with another issue, the rise in oil prices after the Libyan revolution of 1969. The new dimension had to be introduced in steps:

(1) The removal of the national posted prices.

(2) Equalisation of posted price and market price.

(3) Taking account of quality of crudes and location of individual countries in arriving at posted price.

(4) The move by OPEC governments to play an important part in determining the posted price.

The first sign of the upheaval was the change by Libya of its posted prices in September 1970, which in turn led to the development of the Tehran and Tripoli agreements. This argument has been developed as a bargaining problem between Libya and international oil companies as will be seen in Chapter 7. Much of Libya's political significance today is rooted in its emergence in the 1960s as a major crude oil producer. Libya was seen by Western oil strategists as an alternative to the "*unstable*" political environment that characterized the rest of the Arab world in the 1950s and 1960s. Pushed by the dynamics of competition between the Major and Independent oil companies and free from any political interference from the Libyan monarchy, prices for Libyan crude remained solid as the market for Libyan oil expanded. Nevertheless, encouraged by Libya's advantageous position, King Idriss demanded a 10 cent increase in the posted price for Libyan oil. When the companies hesitated, the King gave them an ultimatum, either to raise their posted prices to levels assessed by the government or to be ready to face unilateral action. The deadline to comply with the ultimatum was 1 September 1969. On that day, a revolution brought young army officers to power in Libya.

As the first anniversary of the revolution approached, the Libyan officials, recognizing the strength of their position, concentrated their negotiating pressure on Occidental and Esso. Libya's tactic in dividing the oil companies and its role in transforming power from international oil companies to OPEC will be discussed further in Chapter 7. However, on 30

August 1970 Occidental gave way, reportedly under the threat of take-over. Posted prices were raised on 1 September 1970 by 30 cents per barrel, with a further rise to $2.55 per barrel on January 1971. Taxes were raised to 58% as opposed to the previous 50-50 sharing formula. Some of the tax rates varied, but the basic rate for government profit in Libya was now firmly established at 55%.

This was only a prelude to the world-wide wave of bargaining which began when other OPEC members started to follow the Libyan lead. The major oil companies were aware that the Libyan settlement would prompt a new wave of demands by the other oil-producing countries. Between 9 and 12 December 1970 the Twenty-First OPEC Conference met in Caracas, Venezuela, and adopted Resolution 120, which recommended the following principles:

(1) The establishment of a 55% minimum rate for taxation of company net income, where net income is defined as gross income minus production cost and royalty payments.

(2) A uniform posted price in all member countries equal to that of the most favoured countries.

(3) A uniform increase in posted prices in order to reflect favorable trends in world market prices.

(4) The adoption of a new system for the calculation of quality and location differentials affecting market prices.

(5) The elimination of all discounts offered on crude export prices on 1 January 1971.

To realize these ends, the conference decided on a negotiating strategy designed around three regional groupings: the Arab Gulf countries, the Mediterranean exporters, and Venezuela and Indonesia. The first round of negotiations with the companies was set for 12 January 1971, in Tehran. The Gulf negotiating team was to consist of Iran, Saudi Arabia and Iraq.

However, on 3 January, even before the Tehran negotiations started, local Libyan representatives of the oil companies were called upon by Deputy Prime Minister Abdul Salam Jalloud. Libya presented a new set of demands:

(1) A 5% rise in the tax rate in line with the Gulf countries, with retroactive claims to be settled either by a cash payment (with a 10% discount), or by five-year installments plus interest, or a tax rate above 55%.

(2) A post-1967 freight differential and a post-May 1970 freight differential, to be 39 cents per barrel and 30 cents per barrel respectively.

(3) Monthly rather than quarterly tax payments.

(4) Increased investment in oil and non-oil areas, amounting to at least 25 cents per barrel of exported oil.

If they did not comply with these demands, the companies would be forced to shut down oil production and risk nationalisation. This unilateral move by Libya was probably designed to put pressure on its partners in OPEC before the Tehran negotiations commenced.

The companies, according to Chevalier [1975 p.50], were given government authorization to act collectively, which was, in theory, contrary to anti-trust legislation. This meant that the cartel was made official and given the blessing of the American, British, French and Dutch governments. The companies message to OPEC on 16 January 1971, proposing no retroactive payments or new increases in the tax percentage level beyond current levels and no new obligatory investment.

The Tehran agreement was signed on 14 February 1971. Member countries decided upon the tax terms containing the following points:

(1) Total tax rates on income to be stabilised at 55%.

(2) Elimination of all previous discounts worth 3 or 4 cents per barrel.

With the financial issues out of the way, OPEC members turned their attention to the issue of government participation in the oil companies. Participation, as we will see in the next section, was soon replaced by complete nationalisation in many OPEC countries, which put an end to the companies' control of production and opened a new era of oil exporting countries' control of production.

In the discussion on the progress of OPEC, I distinguish between the following:

(1) Determination of prices and output quotas.

(2) The relationship between the organization and the oil companies.

So far OPEC have succeeded in dealing with the first point as we have seen from the progress they made concerning tax and related matters. The argument concerning oil prices will be discussed in some detail in Chapter 7. Here I concentrate the discussion on the second point, which is equally important for OPEC, because the companies not only produce the crude for the countries but they sell, market and refine these crudes. In this area OPEC had no previous experience. For OPEC to understand the market, it had to participate in the ownership of the experienced oil companies, and therefore practice the kind of work they do. Participation also facilitates OPEC's enforcement of its decisions regarding the oil market and the oil companies. The enforcement is complete when the companies are nationalized, allowing OPEC decisions concerning oil prices or output to be final.

4.3 Participation and nationalisation:

Participation was a relatively new concept for the OPEC governments to advance. Historically, nationalisation has been seen as the only way to break the hold of a foreign monopoly over a developing country. Its benefits are twofold, eliminating foreign domination and requiring a

reorientation of the local economy. Although nationalisation had occured within the oil industry both before and after the formation of OPEC, the producing countries had, generally speaking, avoided nationalisation, partly because of the failure of Mosaddiq's nationalisation of the Anglo-Iranian Oil Company (AIOC) in Iran in 1953. Early in 1948 the AIOC had proposed discussions with the Iranian Government to seek ways of remedying the evident prejudice to Iran of the British Government's policy of limiting dividend payments, since the Company was obliged to pay the Iranian Government a sum equal to 20% of its dividend payments over a specified sum in addition to the royalty of 4 gold shillings per ton. Although an agreement on new terms was reached in the negotiations it was not ratified by the Iranian Parliament, and the relations between the Company and the Government went from bad to worse, culminating in the nationalisation of the Company in 1951. The dispute dragged on for two more years, involving the International Court, the United Nations, and the intervention of the U.S., with the issue of compensation becoming central. Finally, in 1953 came the fall of the Government of Mosaddiq, and negotiations were opened under a new Iranian Government. These ended in the creation of an International Consortium to operate the oil installations of southern Iran but did not, in principle reverse the nationalisation [Penrose 1968 p.66]. Even though the first attempt at oil nationalisation failed, for some OPEC nationalists the whole concept of oil concessions, granted to the oil companies in earlier times under disadvantageous conditions, was increasingly unacceptable. They argued that the only way to get rid of these unfair concession agreements was by nationalisation.

However, most OPEC members, ever mindful of the disastrous Mosaddiq episode, favoured the more cautious method of participation. This

conservative tendency provoked the emergence of the "anti-OPEC" group of oil experts and economists, whose political program for the OPEC oil producers was based on the desirability of nationalising the foreign companies. Even in Iran itself, oil after Mosaddiq was not de-nationalised. But a comparison with the Mosaddiq crisis shows how thoroughly the bargaining situation had been reversed. In the early 1950s, British Petroleum had increased its production in Iraq, Kuwait, and elsewhere to make up for the shutdown in Iran, and the Iranian government, without financial reserves, was soon on the verge of bankruptcy. In the early 1970s, OPEC repeatedly made it clear that, in case of deadlock, a company would not be allowed to increase production elsewhere and might even find itself embargoed throughout OPEC. This time, whereas the companies and the oil-consuming countries disposed of stored reserves of petroleum ranging from one to three months consumption, the major OPEC governments, thanks to their earlier success, had financial reserves for a year or more. This was particularly true in the case of the Libyan confrontation with the oil companies, which will be dealt with when I come to the discussion of the Libyan case in Chapters 6 and 7. Indeed, the production cutbacks in connection with the Arab embargo of 1973 showed that the less oil OPEC produced, the more it would receive in payment [Rustow 1976 p.29].

Iraq was the first country to ask for participation, in 1961. The refusal of the Iraqi Petroleum Company was one of the major factors leading to Law 80 of December 1961, reclaiming all but 0.5 % of the concession area. Saudi Arabia, a long-term moderate in oil policy, hoped for participation, especially after the June 1967 Arab-Israeli war, and the frustration and pressure for nationalisation of Western interests that the defeat of the Arabs produced. However, there was no determined and

immediately decisive follow-up. It was generally felt that the conditions in the 1960s were not opportune for the confrontation with the companies that would have been inevitable. The cry for nationalisation enjoyed much more appeal among countries concerned about and involved in oil matters and national control over resources. Elsewhere, the favourite mechanism for control was equity participation, that is, partial ownership of the ventures, rising rapidly to constitute majority control.

The debate between the advocates of nationalisation and those of participation was heated most of the time from the 1960s to the early 1970s. But as hindsight now shows us, there was not much substance in the controversy, as the orientations and positions of the governments in the two camps translated into actual policies revealed in due course. Thus, none of the governments that had opted in theory for nationalisation did in practice nationalise all the companies operating on its soil in one blow. Also, none of the governments that had opted for participation failed in due course to acquire majority equity participation. During the 1970s the differentiated picture falls within two distant limits; between 60% and 100% ownership and control of oil companies was held by OPEC countries.

In June 1968, OPEC issued a major document entitled "*Declaratory Statement of Petroleum Policy in Member countries*" [OPEC Resolutions 24-25 June 1968]. The document stipulated, among other things, that "*Where provision for Governmental participation in the ownership of the concession-holding company under any of the present petroleum contracts has not been made, the government may acquire a reasonable participation, on the grounds of the principle of changing circumstances. If such provision has actually been made but avoided by the operators concerned, the rate provided for shall serve as a minimum basis for the participation to be acquired*". This was the most significant step taken by OPEC as a body in

the 1960s towards control by its members of their oil resources, and the activities and operations related to oil.

The companies were not slow to react, as their practice had been on similar occasions when the governments had indicated the will and determination to act unilaterally. But, whatever the effect of the resistance, it was probably the governments' own slowness to go into confrontation at the time that was the major reason participation only made headway some three years later. It seems likely that the individual preference of some governments for nationalisation was one reason why they did not press for equity participation. Two price agreements reached after considerable pressure, in Tehran and Tripoli in February and April 1971 respectively, had to intervene, before the governments turned to participation as a priority. It seems most likely that they wanted to dispose of the price question first. Having done so and worked out a formula meant to last for five years, they felt they could tackle participation.

In its conference in July 1971, OPEC resolved "*That Member Countries shall take immediate steps towards the effective implementation of the principle of Participation in the existing oil concessions. To this end, a Ministerial Committee shall be formed ... to draw up the bases for the implementation of effective participation ... and to submit its recommendations to an extraordinary meeting ... on 22nd September 1971*" [OPEC Resolution XXIV.135, 22 September, 1971]. The sense of urgency was expressed in the setting of the date for an extraordinary meeting. This meeting was duly held and resolved:

(1) That all Member Countries concerned shall establish negotiations with the oil companies, either individually or in groups, with a view to achieving effective participation on the bases proposed by the said

Ministerial Committee.

(2) That the results of the negotiations shall be submitted to the Conference for coordination. In case such negotiations fail to achieve their purpose, the Conference shall determine a procedure with a view to enforcing and achieving the objectives of effective participation through concerted action [OPEC Resolution XXV. 139]. The emphasised part of the Resolution is significant; it introduces enforcement, it talks of effective participation and it warns that concerted action would be taken if the companies balked, rather than weaker individual action. The Gulf group of OPEC members originally had in mind an initial 20 % participation, to rise to 51%. Libya, on the other hand, wanted an immediate 51% participation in the ownership of oil companies. In its desire for majority control, it was guided by two factors; its own position involving great concern for as quick a take-over of a determining position as possible, and Algeria's nationalisation of 51% of the French companies operating in its territory in February 1971.

The negotiations were so tough and unproductive that the Monarch of Saudi Arabia had himself to issue a royal warning, that unilateral action would be taken if the oil companies continued in their stand. This intervention was occasioned by Aramco's attempting last-minute diversionary action that in fact aimed at avoiding the question of participation in existing ventures, and offered a large ratio in ventures yet to be undertaken. Finally the companies gave in, and accepted participation with an initial slice of 20%. But this was only in March 1972. By that time, OPEC members were getting so impatient that they had almost come to the point of legislating participation at the level of 51% and acquiring control in one stroke.

While the negotiations for the terms of compensation were taking place,

two significant measures were taken by Libya and Iraq. The first nationalised British Petroleum assets, because of Britain's failure to act to stop the occupation by Iran of three Arab islands in the lower part of the Arabian Gulf, which had been under British protection shortly before. The second nationalised the Iraq Petroleum Company (IPC) (except for the share of the Compagnie Francaise des Petroles) on 1 June 1972, thus "*leapfrogging*" the participation arrangements. However, the Mosul Petroleum Company (MPC) and Basarah Petroleum Company (BPC) were not touched at the time.

A package deal was finally agreed in October 1972, for the Gulf producers, involving gradual participation, and "buy-back" of government crude entitlement under participation. The increments of participation were to be as follows: 25%, 30%, 35%, 40%, 45%, and 51% equity acquisition on the first day of 1973, 1978, 1979, 1980, and 1982 respectively. Iraq did not adhere to the arrangements insofar as MPC and BPC were concerned, preferring to go on with its nationalisation policy, while Libya saw that the pace as too slow, as it aimed to obtain a minimum of 50% participation immediately (as it had done under a recent agreement with ENI, the Italian State Oil Company).

The Gulf agreement could have been seen as a force for stability, as it seemed to satisfy the aspiration of the governments, though not ideally. However, it turned out to be an incentive for more gains, sooner than provided for. In March 1973, Iraq and the IPC group (that is, IPC itself along with MPC and BPC) reached an overall settlement involving compensation for the nationalised northern fields and expansion in production and export capacity for Basarah fields. In Libya, between January and September 1973, most of the independents and some of the majors submitted to the governments' demand for 51% equity participation. In

Venezuela the ownership and management of the oil industry reverted to the government in accordance with the promulgation of the 1974 Law of Nationalising of Venezuela Oil Operations, that was put into effect the following year. However, negotiations were conducted with the ex-shareholders, mainly Exxon and Shell, which led to some arrangements by which those companies continued to extract an important part of Venezuelan oil, currently two thirds, under conditions which are similar to those applicable in Kuwait [Al-Chalabi 1980 p.47].

By 1974, not only had the terms of the agreement with the Gulf members of OPEC been bettered by Iraq and the Mediterranean oil countries, but the Gulf countries also wanted larger participation. The Arab-Israeli war of October 1973, with all the dramatic and historical events and changes it brought with it in the fields of oil economics and power relationships, had intervened, and with it a severe tightening in the oil market. The circumstances had changed almost beyond recognition, and the power structure pre-dominating before the war collapsed. Consequently, all the members of OPEC wanted majority control, and the companies gave in. Kuwait, Saudi Arabia, Qatar, and Abu Dhabi raised the level of their participation to 60%, then Kuwait reached 100% or full take-over in December 1975. Qatar followed suit with the Qatar Petroleum Company (QPC) and Shell in 1976-7. Saudi Arabia finished negotiations with Aramco for 100% take-over in 1977 (with retroactivity of terms to the first day of 1976). Iraq completed nationalisation by 1975. The picture is mixed in Libya, with some companies retaining a 49% interest, but most others were fully taken over. In Algeria all companies have been nationalised except for the CFP which holds a 49% interest. For all nationalisations the governments proposed net book value for compensation which, after long debate was accepted by the companies.

One of the most important consequences of the participation-nationalisation transformation is that the entry of the state into the planning and management of investment operations for the oil sector by establishing national oil companies inevitably triggers other structural changes in the national economy. These lead towards closer integration of the oil sector into the national economy, through intersectoral investment linkages, acquisition of technology, new employment and investment opportunities, etc.. It also strengthens the link between the oil sector, as a source of energy, or as an industrial input for the chemical, petrochemical and fertilizer industries or services, and the other sectors of the national economy. Decisions on petroleum matters, including oil search and exploration, production capacity, export facilities, as well as decisions on pricing and marketing, etc. have, on their transfer to the state, become influenced by considerations of state sovereignty and its political requirements, especially those pertaining to economic growth and social development. This is important in defining the structural features of the oil industry at the production phase today, because the oil sector is central to the national economy of the producing countries. In the final analysis it determines the level of economic activity, the foreign exchange reserves of the economy, the general level of investment and employment, etc..

The national oil companies (NOCs) must, of necessity, operate within the framework of these strategies and their investment decisions will not be subject to purely commercial considerations and profitability criteria, but will be largely determined within the general framework of achieving economic and political development. In other words, the national oil companies, unlike the foreign companies, will not necessarily always act on the same principles as a commercial entrepreneur, especially where

financial costs are concerned, since these now tend to be regarded as part of the general social cost of maximizing social welfare in the producing country. I will provide an example of NOCs activities through the study of the Libyan National Oil Corporation (LiNoCo) in Chapter 7.

Another important consequence of strutural change is that investment decisions at the upstream phase of the oil industry are no longer linked with decisions and investments pertaining to the subsequent oil operations in the consuming countries (the downstream). This represents a change from the practice of the companies, which previously invested in crude on the basis of their forecasts for subsequent refining and distribution activities.

However, members of OPEC have never concealed their readiness to learn from the former controlling power in the oil industry (the majors), and, not surprisingly, the countries are finding that the path taken long ago by the companies in adopting an integrated approach to the industry is also a logical path to follow. Some NOCs are venturing into refining and products' marketing alongside their crude oil export operations. Several NOCs have their own tanker fleets, and since they are now directly involved in the production of crude oil, there is a growing awareness on their part of the need to put an end to the utter waste involved in the flaring of associated gas. This has led to rapid growth of investment in efforts to achieve the complete utilization of associated gas in reinjection, in export, in processing and petrochemicals and, significantly, through intensified domestic consumption as a substitute for other fuels which might be more remunerative as exports. Surely it is only to be expected that the mere existence of national oil companies will, in itself, lead to ventures in downstream operations and related activities, following the example already set by the multinationals. This involvement is intensified

by the fact that OPEC NOCs naturally feel that it is their duty to assist their countries' development efforts.

Thus, oil exporting countries have succeeded after a long struggle in overcoming the problems which prevented them from having a free-hand in managing their resources. Even though it took them a complete decade (1960s) to move from profit-sharing issue to other important issues, their progress during the 1970s was impressive.

In the next chapter and through the rest of this thesis I will consider Libyan oil development as a case study, not only, to present an OPEC member's experience in upstream and downstream operations, but also, and probably more important, to assess Libyan achievements in regard to the control of its oil resources and its role in the upheaval movement which, once started, gained fruit and strength for all OPEC members.

Part II

CHAPTER 5: THE PRE-OIL LIBYAN ECONOMY AND THE DISCOVERY OF OIL

Libya, as any other developing country, has been facing severe economic problems. Geographical, historical and economic factors have made Libya a country of hardship and very low income. A United Nations census taken in 1954 showed that three-quarters of the population were classified as settled and the remainder as nomadic or semi-nomadic. One-quarter of the settled population was concentrated in the main cities of Tripoli (130,000) and Benghazi (70,000). The proportion of nomads was highest in Cyrenaica, with 45% of the total population, and lowest in the Fezzan at 10%.

Since independence in 1951 the Government of Libya has not been in the hands of experienced managers of its national economy. On occasions teams of experts, such as that of the International Bank, have been called in, but in general the direction of the economy has been in Libyan hands, and at first in the hands of the traditional leaders. The acquisition of experience in national economic management has not been a continuous or a progressive affair. There have been many discontinuities and lessons have had to be learned a number of times.

Of the whole area of the country, not more than 10% could be put to productive use owing to lack of water, and only 1% was suitable for settled cultivation. Even though the Government after independence received substantial foreign aid, compared to the national income, it could do little with it to build up the necessary base for the Libyan economy.

This chapter, as the first step, will assess the pre-oil Libyan endowment of factors of production as follows:

(1) Natural resources: total land area and whatever it contains that has an economic value, such as rivers, forests, minerals and hydrocarbons.

(2) Location: even though this is not a factor of production according to

text book definitions of productive factors, it can be treated as a factor of production.

(3) Labour force and its structure: population, skilled and unskilled labour, and the role of children and women in the economy.

(4) Capital: that portion of goods, physical assets or equipment created in Libya but not consumed at that time

Since planning for development is a task of expertise, which Libya at that time at least could not provide locally, the United Nations was asked to provide the necessary experience for this job. This topic, together with other forms of foreign assistance and development projects will be discussed under separate headings.

In the succeeding section I will observe the change in available natural resources caused by the discovery of oil in commercial quantities. I also discuss the development of the oil sector, including upstream operations such as oil exploration, production, transportation and other facilities, marketing and pricing.

The power of Libya in its negotiations with oil companies, has its roots in this very first fact of troubled historical and economic conditions. In the words of Colonel Qadhafi, who emerged as Leader of the 1st September Revolution in 1969, in his address to the oil companies: "*the Libyan people, who have lived five thousand years without petroleum, are able to live again without it*". This fact, in effect, was coupled by the discovery of oil in Libya in commercial quantities in a very short time. Oil revenues increased with every barrel of crude exported. Exports accelerated from almost zero in 1961 to over 3 million barrels per day in 1970. It was clear that the Libyan economy could not absorb such huge revenues. At the time of negotiations with the oil companies in the early 1970s, Libya had enough foreign reserves to finance its economy for two

years at the then current expenditure level. Thus, poor economic conditions experienced by Libya, together with fast development of the oil sector and vast oil revenues have had a great effect on the Libyan relationship with the oil companies. The ability of Libya to alter these relationships to its benefit has emerged from the above situation. In this chapter I will discuss these issues; that is, the pre-oil Libyan economy, and the emergence of the petroleum sector.

5.1 Pre-oil Libyan economy:

To study the pre-oil Libyan economy, I concentrate first on the endowment of the main factors of production; land, location, labour and capital. The favoured location of Libya has not only marked its history with successive foreign interventions, but to some extent has shaped its economy. The main features of this economy have been the lack of both human and capital investment. The measurement of these factors reflects the economic reality of the economy and provides a natural base to the assessment of oil discoveries and its effect on the economy. There is no doubt that the discovery of oil in the 1960s (as discussed in Chapter 6) has shaped the Libya of today, but some of the old economic problems, such as lack of skilled labour, are still the main constraints on the development of the Libyan economy.

5.1.1 Land:

Land consists of the sum of all natural resources possessed by Libya i.e those earning assets not created by Libyans or immigrants to Libya throughout history. Libya is a country with a vast area of 1,760,000 square kilometres. It had a population of around one million, at the time of independence in 1951. It comprised two areas of agricultural and pastoral development the Gefara or coastal plain of Tripolitania and the plateau region of Cyrenaica.

Geographically, the overriding environmental factor affecting Libyan renewable resources is the absence of rainfall over more than 90% of the country, and the relative and seasonal deficiency of rainfall over the remaining coastal regions in the vicinity of Tripoli and Benghazi. The seasonal pattern of rainfall limits rainfed farming to regions within the 200mm isohyet, which amounts to less than 2% of Libya, of which less than half is cultivable for reasons of terrain and soil conditions. A 200mm average rainfall is not, however, ideal for dryland farming in regions in which high temperatures and dry winds can occur at any time of the year.

Underground water varies in depth from one part of the country to another (in some parts of Fezzan underground water is only 5 meters deep). This water, which is the most valuable non-renewable resource after oil, is tapped from artesian wells and also from the general water table. The problem facing Libya at independence was that the huge reservoir of water was located in the heart of the desert, and needed very large investment of capital, which Libya lacked, to extract and transport water to the coastal areas hundred of miles away. It was only in the 1980s that the Government established a new scheme, " *the great artificial river*", to move this water to the coastal agricultural regions. Several springs exist, mostly in the mountain areas, but their potential is still unknown.

In addition, Libya has non-oil mineral resources which, other than a large iron-ore deposit in the Wadi Al-Shati (in Fezzan), are either insignificant or yet unproven as in the case of Gypsum, Salt and Limestone. The Wadi Al-Shati iron-ore, also, had not been exploited because of the lack of capital. By the end of the 1970s a new scheme was put forward to utilise these deposits at Musrata on the coast, where the iron-ore would be processed. This is expected to come on-stream by the mid 1980s. Other mineral resources exist in southern Libya, and the most controversial is

uranium, which is claimed to exist in the border area with Chad. Uranium has already, or soon will be, exported from the central Sahara from Niger, Algeria, Mali and Morocco.

5.1.2 Location:

Libya was an easy target to all invaders through history till 1951. Its location in the mid-Mediterranean North Africa, made it a natural link between Europe and Central Africa, and between the Middle East and North West Africa, The Phoenicians were followed by Greeks, Romans, Arabs, Turks, Italians and finally the British and French military administrations. Most of the time Libya was looked upon by the occupants as a strategic military site or as a base for armies and a bridge to other lands. The domestic economy was almost neglected except for the foreign settlers' needs.

The strategic location of Libya in North Africa and near to the troubled Middle East, had not only attracted the old powers in the world throughout the history as will be discussed briefly below, but its position has also been of great importance to the modern global powers. The independence movement in the Middle East after the Second War, especially the fall of the monarchy of Farouk in Egypt, and the emergence of the anti-Western revolutionary Government in 1952 under the leadership of Nasser, has caused the Western powers, and America in particular, to search for allies nearby in the Middle East. The purpose of the Western forces (especially the US) for being in Libya was not only to act in case of trouble, as in the 1967 Arab Israeli war, where the British Military Base in Al-Adam near to the Egyptian border was used to help Israel against the Arabs, but also to draw a line for Soviet influence.

Moreover, the location of Libya has been of major significance since the discovery of oil on Libyan territory. The transport of Libyan crude to oil refineries in Europe takes less time than other crudes. This advantage of

Libyan oil, is shared with Algerian and Nigerian oils; together they are known as "*short-haul oils*" , and have yielded large sums of hard currency to these producers, as will be shown in Chapter 7.

During the Ottman Empire (1551-1911), Libya depended on two sources of income. Both of these resulted from the geographical position of the country; trans-shipping goods between Europe and Africa, and extracting taxes on foreign ships.

The Libyans used to trans-ship European domestic and imported products to Africa. On their way back to Europe they carried with them ivory, gold-dust, ostrich feathers, vegetables and slaves. This trade decreased sharply after the occupation of Ivory Coast by France in 1893, which made direct trade between Africa and Europe very much easier and quicker than through the vast Libyan desert. The Ottomans had a strong navy centered in Tripoli, which they used to impose taxes on the ships using the nearby sea.

Italy, following in the steps of Great Britain and France, wanted to have colonies for itself. The location of Libya near to Europe offered Italy an easy target to fulfil these dream. Indeed, some refered to Libya as "*Italy's fourth shore*", after Italy established control over Libya in 1934. The Italian Government paid particular attention to economic development, which formed the major part of their economic programme. This was just beginning to yield fruit when the Second World War broke out, resulting in the destruction of most of the farms. The remainder were neglected, especially in Cyrenaica, where the Italians left their farms and workshops and fled back to Italy.

On emerging from the colonial era and the Second World War, Libya faced an intractable development problem which appeared to be almost impossible to solve. Neither history nor nature could provide economic comfort. By independence Libya found itself very poorly endowed with skilled and

educated manpower, a most important product of accumulation over time, and a crucial resource for economic development. The lack of capital investment, the constraints on agricultural progress, the peculiarities of geography, and the distances which separate the Fezzan and the settlements around Benghazi and Tripoli from each other, which run into hundreds of miles, all seemed to pose insuperable obstacles. Planning for such an economy was a heavy task, and help was provided at the request of the Libyan Government, as will be discussed below.

5.1.3 Labour:

Although the population was over one million inhabitants, in the 1950s, Libya was not underpopulated relative to its natural resources and its state of development. It will be seen in Chapter 6 that Libya, after the discovery of oil, has become a major importer of labour.

Unlike its neighbouring countries, which were not short of population compared to the size of the country, such as in Egypt and Tunisia, a 1911 Turkish census of Libya found the indigenous population to be 1,523,176. The population was reduced to almost half the 1911 figure, to 760,000, by 1939 (as an Italian census showed) [Zlitini 1972 p.20]. This was due mainly to the loss of life in the war against Italy, and in part to the emigration of Libyans to Tunisia and Egypt. This reduction in population caused, decline in domestic production.

Before the Second War, a considerable number of Jews were engaged in trading and small enterprises, but the occupation of Palestine attracted this group, and offered them capital investment opportunities. By 1951 only 7,000 Jews remained in Libya, and these left for Israel after the 1967 Arab-Israeli war. There were skilled workers among the Italian population who settled in Libya, while other prominent Italians owned large scale enterprises in agriculture, industry, commerce and finance. Some of the

large fruit groves, dairies, tobacco farms, wheat farms, etc., were quite impressive technically. This group also went back to Italy after the 1969 revolution. This population, however, did not provide any qualified labour force to Libya, unlike Tunisia or Egypt as mentioned above. The manpower problem was in the form of inadequate skill and low productivity. Probably the ratio of active to total population was high because about one-quarter of the children between 10 and 14 years of age were members of the labour force. In periods of drought and off-seasons, a substantial volume of visible unemployment could be seen everywhere, especially in Tripolitania and Cyrenaica, where unemployment might exceed half the labour force of some districts when drought was acute. As education became more widespread, unemployment was partially offset by reduced reliance on child labour.

Libya is a male dominated society; the husband is the complete master of his family and household activities. The status of women has an important impact on development. As Arthur Lewis [1955 p.116] said, "*Restrictions on the work women may do are also everywhere a barrier to economic growth...*" If women are allowed to work outside the home, the supply of labour is augmented. Simultaneously, the money women earn creates demand and helps create a larger market for consumer goods. A large market increases the opportunities for specialisation. However, the work restrictions placed on women represent a formidable barrier to economic development.

In 1952, Benjamin Higgins described the Libyan labour force as "*almost wholly male*" [Higgins 1953 p.8]. Although females worked in agriculture during the peak seasons, virtually no women were found in urban industry or service occupations. Nearly 20 years later the International Labour Organization (ILO) found that the status of women was virtually unchanged. In a 1971 survey, which covered 21,915 employees (approximately 5% of the

labour force), the ILO team found only 1,108 or 5% of the employees were women [ILO 1971]. Of these, 579 or 2.6% were Libyan women, and 529 or 2.4% non-Libyan. However, of the 17,384 Libyans in the survey, only 3.2% were women, but non-Libyan women comprised 13% of the non-Libyan employees covered in the survey.

In the professional, administrative, technical, and clerical categories, non-Libyan women outranked the Libyan women by 7 to 1. Approximately 99% of the non-Libyan women were employed in professional, technical and clerical occupations, while 87% of the Libyan women were employed in unskilled and semi-skilled occupations, such as packers and cleaners. Occupations which are normally staffed by women in the industrial world are primarily reserved for men in Libya. For example, there were 755 general clerks covered in the ILO survey, but only 8 were Libyan women. Of 212 typists only 66 were women, of whom only 19 were Libyan. There were 71 telephone operators, but only one was a Libyan woman.

In the pre-oil period, the education of females was being seriously neglected. In the 1958 academic year there were 97,563 elementary students, of this total only 16,438 (16.8%) were female. In the same academic year there were 5,058 students in junior high school, but only 172 (3.4%) female students. There were 1,536 male students in secondary schools, but only 40 females (2.6%).

Successive invasions and dominations left Libya with minimal human resources. In 1936, it was estimated that 95% of the Libyan population was illiterate. In 1939, only 9,646 Libyans attended public schools in Libya. A large number attended Koranic schools, but the teaching was limited to Koranic scripture and elementary Arabic. Only 282 students were enrolled in secondary schools [Lindberg 1952 p.7]. The situation had improved somewhat by independence. Even considering the improvements of early years

of independence, only 20% of the students of elementary and secondary school-age children were attending school. There were no colleges or universities in the country. With the aid of the United Nations, Libya was able to increase the proportion of students in the educational system from 1950 to 1959. Just prior to the discovery of oil in 1958 there were 97,563 elementary students, 5,058 junior high school students, and 1,081 secondary students attending public schools in Libya [Ministry of Education 1972 p.7]. The teaching staff was dominated by Egyptians, and in many schools the Egyptian curriculum was followed without modification. The world Bank Mission criticised the curriculum as being "*too academic*". The Mission Report suggested that more emphasis should be placed on vocational training [UNESCO 1952 p.9].

Although the number of students increased during the 1950s, there was a considerable waste in the educational system. In the 1958-1959 academic year there were 34,530 students enroled in the first year of elementary school. Of these students, only 11,752, or about 9% of the total population, completed the sixth year of elementary school, and only 4,558 (3.5% of the population) completed the eighth grade. The high drop-out rate was one factor that contributed to the high illiteracy rate.

According to the official census figures of 1954, 81.1% of the total population was illiterate. Between 1954 and 1964 there had been a significant increase in the number of students attending schools, but the census figure of 1964 reported that over 73% of the Libyan citizens were still illiterate. Functional illiteracy was probably even higher than this. Another 21.6% could "read only" or "read and write". In 1964 only 5.2% of the population had completed primary school or more education as shown in Table 5.1.

Table 5.1

Citizens and Total Population, Six Years and Over

By Sex and Educational Status: 1964

Educational Status	Total			Citizens		
	Total	Female	Male	Total	Female	Male
Illiterate	868,704	514,708	354,286	863,468	511,815	351,653
Read only	13,060	2,845	10,215	12,838	2,746	10,092
Read and write	262,813	51,667	211,146	343,558	41,685	201,873
Primary cert.	43,789	6,569	37,220	39,539	4,458	35,081
Prep. cert.	19,611	3,358	16,253	16,145	1,500	14,645
General sec. cert.	9,099	2,599	6,500	4,750	295	4,455
Graduate & above	5,277	1,061	4,216	1,523	96	1,427
Not stated	939	448	491	373	157	216
Total	1,223,582	583,255	640,327	1,182,194	562,752	619,442

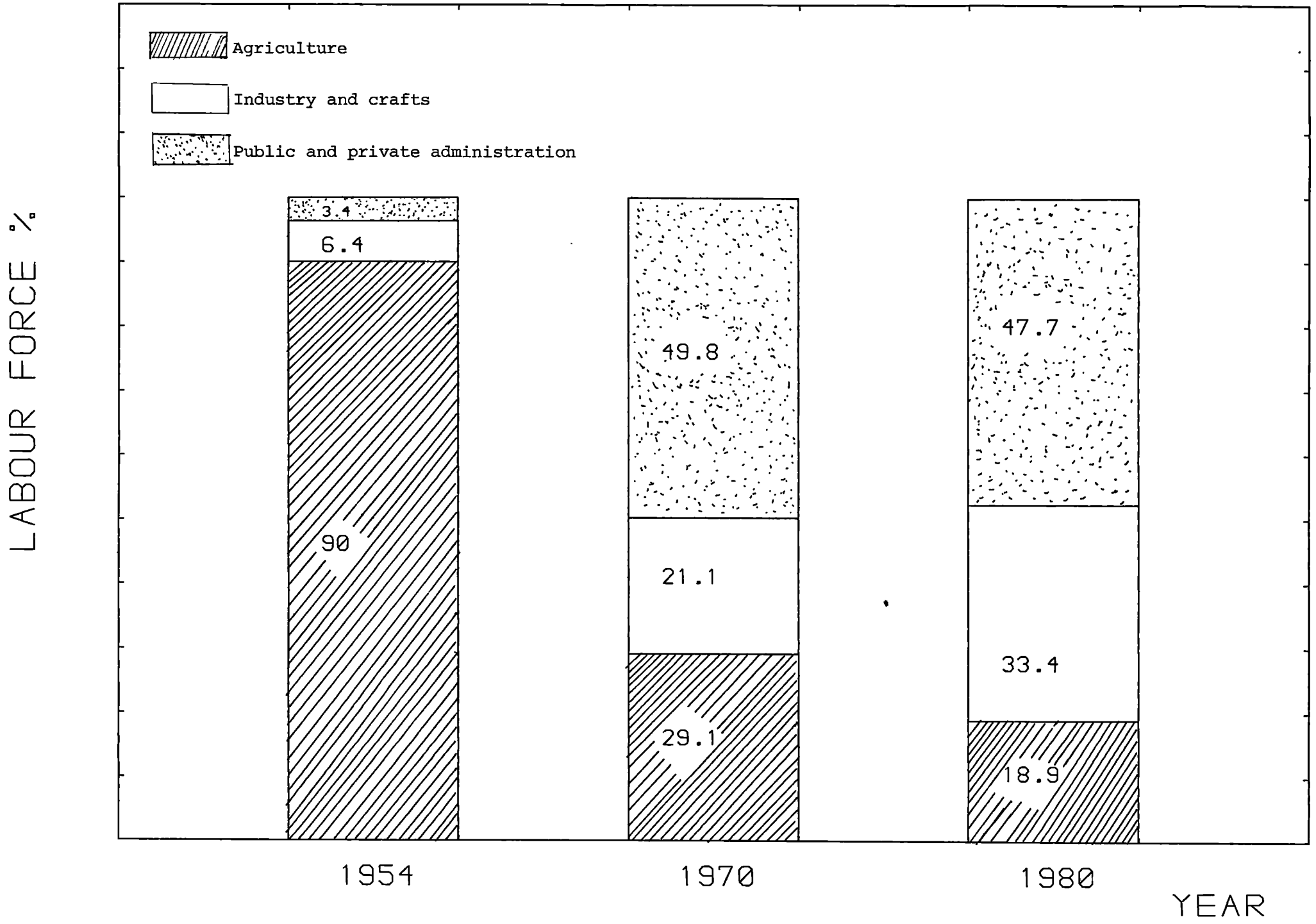
Source: Ministry of Planning, *Statistical Abstract*, [1969], p.41.

Nearly 90% of the labour force was engaged in agriculture, for the most part employing only the crudest of agricultural techniques. Industry and crafts together absorbed little more than 6% of the labour force, public and private administration about 3%. Manpower was hardly differentiated as to skill at all, except for workers engaged in handicrafts [Ministry of Planning 1974]. This pattern has almost completely reversed in the 1970s, as shown in Diagram 5.1. This change was mainly due to the beginning of the oil era and the conseqent gradual domination of economic activities by the public sector.

5.1.4 Capital:

At the time of independence in 1951, Libya, like other underdeveloped countries, was short of capital in the broad sense; ie. reproducible capital (plant, machinery, equipment, etc.), non-reproducible capital such

Diagram 5.1


Agriculture
Industry and crafts
Public and private administration
LABOUR FORCE %
3.4
6.4
90
49.8
21.1
29.1
47.7
33.4
18.9
1954
1970
1980
YEAR

as land and intermediate goods, and services which were used up within one year. Both the existing *real capital* and the flow of monetary savings available for investment purposes were inadequate. Capital in both these senses was particularly scarce. Outside the Italian economic activities the existing plant, equipment, and housing were meager indeed; capital goods accumulated by the Italians suffered extensive damage during the Second War, and much of what remained was a drain on the economy. It was expensive to maintain, and much of it was appropriate only to a more advanced economy. Except for the very few wealthy families, the accumulated capital of the Libyan population consisted mainly of livestock, tools, a little light equipment, and housing that ranged from simple to primitive. Even this capital suffered depletion during the war.

The supply of capital in the monetary sense was restricted by the extreme poverty of the people. No accurate statistics exist, but it is apparent that the share of national income saved was very small indeed [Higgins 1959 p.29]. Only a fraction of the population was able to save at all, except in years of very good harvest. In these good years, prosperous Libyans might buy land, but this process merely served to bid up the price of land, and was a transfer of assets rather than saving. Alternatively, the population could add to its livestock and to its store of silver ornaments. Neither of these forms of accumulation represented saving in the sense of an offset to increases in private investment and government expenditures. Accumulation of livestock might not even represent a decision to restrict consumption. It might be a mere matter of an increased survival rate of livestock in good years. Nor does saving in either of these forms constitute a source of loan capital; it does not increase the lending power of banks, nor provide a market for new issues of securities. The accumulation of livestock or ornaments is *saving* only in the very formal

sense that it represents a gap between income (including accruals to capital) and current consumption.

For four decades (1920s-1950s), the Libyan budget was in deficit. These deficits were reduced and at times, as in the mid-1950s, turned to surplus by foreign governments; by Italy during the thirty years when Libya was an Italian colony; from 1943 to 1952 by the Administering Powers (the United Kingdom in Tripolitania and Cyrenaica, France in the Fezzan); and since then by foreign aid and leases of military bases. It is only since the export of oil in commercial quantities began in 1963, as will be discussed in Chapter 6, that the Libyan budget deficit has turned to surplus without foreign assistance. Foreign aid effects on the government's budget during the 1950s, can be seen in Table 5.2 below, through the growth of governmet expenditure and revenues. While government expenditure increased from £L3.6 million in 1950-51 to £L20.4 million in 1957-58, the decrease in foreign aid in 1958-60 led to the decline of revenues.

The Lindberg [1952 p.30] study, revealed that the percentage of total family expenditures on food was 80% for city dwellers. The high percentage spent on food suggested a state of poverty resulting in under-nutrition. The calorific content of the average diet was only 1,300 calories per person per day.

Gross Domestic Product (GDP):

Gross Domestic Product (GDP) was £L15 million Libyan Pounds in 1955, or £L14 per capita income, which was very low. By 1958 GDP increased to £L52 million and per capita income to £L40. Apart from the inflation of 5% annually, the increase was due to foreign aid and the revenues from oil companies, which paid for the concessions according to the Petroleum Law, issued in 1955.

Although large segments of the population existed outside the modern

Table 5.2

The Effects of Foreign Aid on Libya's Budget(£LM):1950-1960

Year	Domestic Rev.	External Rev.	Total Rev.	Expenditure	Balance
1950/51	3.658	-	3.658	5.522	-1.864
1951/52	4.171	-	4.171	5.911	-1.740
1952/53	4.881	1.273	6.154	6.618	-0.464
1953/54	5.239	4.013	9.252	8.233	+1.019
1954/55	5.549	5.641	11.190	8.797	+2.393
1955/56	7.016	6.270	13.331	12.978	+0.353
1956/57	8.147	9.979	18.126	15.433	+2.693
1957/58	9.595	10.845	20.440	17.031	+3.409
1958/59	10.269	6.683	16.952	20.024	-3.072
1959/60	11.542	6.821	18.363	20.613	-2.250

(+)Means surplus and (-)means deficit.

Source: Ministry of Planning, [1974], p.4, and J. Allan, [1981], p.77.

economy in a self-sustained nomadic or semi-nomadic way of life, statistical estimates were made of Libyan national income at the time of independence. Income per head was estimated slightly higher than in India but markedly lower than other Middle Eastern countries. In 1952, officials of the British Administration estimated the per capita income in Tripolitania at $40 per annum. The income was subject to fluctuations; income tended to fall in drought years and rise in good crop years.

The structure of GDP in 1958 was as shown in Diagram 5.2 below; 26.1% derived from agriculture, 18.4% from manufacturing and mining, 3.4% from construction, and 1.5% from electricity.

Total goods share was 49.4% while services share was 50.6%. The latter's share was even higher in 1962, as shown in Diagram 5.2 below. This means that investment was concentrated on the service sector rather than the productive sector.

Agricultural development was handicapped by the extreme shortage of skills in agriculture and the scarcity of capital. Erosion had caused significant loss of soil fertility. Infrastructure was almost entirely lacking in the rural areas and badly damaged during the war in the urban areas. There was also a lack of essential technical and economic data needed for the formulation of adequate agricultural development projects [The International Bank for Reconstruction 1960 p.35].

The main cereals were barley and wheat, the main vegetables, potatoes and tomatoes; and the main industrial crop, groundnuts. There was also a wide range of fruit and tree crops and, by contrast, very few field crops. Olives, dates, and almonds were the most important fruits, citrus were largely introduced after the Second World War and seem to have a promising future as will be discussed below. Temperate fruits such as pears, apples, grapes, apricots, peaches, and plums as well as semi-tropical fruit such as

pomegranates and bananas, were produced in Libya. Fruit yields were low compared to world averages; a half to a third of world averages for olives and dates, a quarter to a sixth for citrus.

Fishing as a resource was underdeveloped despite the existence of sponge beds and fishing grounds containing Tuna, Sardines, Red mullet, and other varieties. These beds were actively exploited by foreign fleets, e.g. Greeks, Italian, and Maltese, rather than by Libyan fleets.

Libya's position on the Mediterranean and the proximity to Europe, the main source for tourists, are important factors for a possible tourist industry. However, Libya has two main tourist attractions; beaches which stretch on 1900 km coast on the Mediterranean, and archaeological sites in Liptis, Sabrata and Cyrene. The progress of this industry was slow for reasons such as:

a- The lack of services needed to support a large tourist industry, which requires huge capital investment, ie hotels, infrastructure and transport.

b- Libya was in competition with other Mediteranean countries with a good reputation in this field, such as Malta, Tunisia and many others.

c- Libya is further away from European countries than some other tourist centres such as Morocco, Algeria, Tunisia or Malta.

Before the Italian military invasion of Libya in 1911, Italy could interfere with the Libyan economy. At the end of 19th century a branch of the Bank of Rome was set up in Tripoli. This Bank had two branches in Benghazi and Derna by 1907. The purpose of the Bank was to buy agricultural land and to help the Italian immigrants who were coming in increasing numbers to cultivate and settle on the lands which they or the Bank, had bought. The Bank had some other economic activities and built some factories which tied the Libyan economy to Italian initiatives.

Food processing ventures were few and usually involved government

participation. The Citrus Fruit Corporation was able to raise exports in 1954 to a level 70% higher in volume and more than 100% higher in value than any figure previously attained. This expansion was based partly on improved cleaning and grading with the use of a new machine (and FAO technical assistance), and on an agreement with the Italian government to import the fruit. The other successful ventures in which the Government participated were the tanning industry and the sale of fresh vegetables.

The rural sector comprised nearly 90% of the active population; wages were paid in kind, in money or a mixture of the two. Payment in kind was extensive, especially for indentured labour and for seasonal activities [Higgins 1953 p.86]. The jebbad (drawers of water) were one example of indentured labour that existed in Fezzan. Before the French occupation (1948) of the Fezzan, the jebbad who watered date-palms received one-fourth of the crop. Similarly, with respect to barley, the jebbad was entitled to one-fourth of the crop. Even in recent years, after the oil was discovered (the 1960s), the system was still largely in practice. I remember the jebbad used to have 50% of the crop with respect to olives. Their pay in the pre-oil era was so low that they were constantly in debt to the landlords. The landlords advanced dates, barley and olives; as a result the jebbad lost their freedom of action and mobility [Lindberg 1952]. Also in Cyrenaica ploughing, harvesting of cereals, weaving of wool, and stock tending involved payments in kind fixed by tradition. Money wages payments were mainly confined to the cities or the Italian agricultural schemes.

In the 1950s wage rates in Libya were as low as most of the developing countries. The wage level in agriculture was very depressed (£L0.100 0.150 per day in 1952-54), and the rural/urban wage differential which was small, favoured the emergence of the modern sector.

After the Petroleum Law was issued in 1955, oil companies starting

exploring the desert. These companies offered employment at wages substantially higher than the rates prevailing either in agriculture or industry, and the wage-gap between the traditional and modern sectors widened considerably. Between 1956 and 1959, wage rates in agriculture rose from £L0.140 to £L0.180 per day, but oil companies were employing unskilled labour at rates varying between £L0.250 and £L0.400. This initiative from the oil companies caused some important economic changes, by shifting the labour force from the agricultural lands to oil companies in the desert. Table 5.3 below shows a time series of agricultural wages (median) derived from the records of large farms in Libya.

Table 5.3

Agricultural wages in Libya 1953-1959

Year	Wage £L per day	Index
1953	0.135	100
1954	0.140	103
1955	0.140	103
1956	0.145	107
1957	0.150	111
1958	0.170	126
1959	0.180	133

Source: Libyan University London University Joint Research Project on Libya, [1970], p.164.

Throughout the centuries of colonisation, the Libyans were not only politically dominated but also economically dominated. They suffered loss of lives and wealth; even during the first few years of independence, it was impossible for Libya to survive without foreign assistance.

In Tripoli only, production of corn during sixteen years (1862 1878) showed a surplus in the balance of trade. Exports exceeded imports by

1.515.000 Franc. See Table 5.4 below.

Table 5.4

Tripolitania corn trade surplus (1862-1878)

Corn	Exports in Francs	Imports in Francs
Wheat	14,786,000	7,925,000
Barley	5,076,000	10,422,000
Total	19,862,000	18,347,000
Surplus	1,515,000	

Source: Zlitni [1972], p.7.

The exported goods were livestock, wool, sheep skin, goat hair, dates, olive oil, esparta grass, ground nuts and honey. Even though imports increased at a rate faster than the exports, a trade surplus continued to exist till the Italian invasion of Libya in 1911 as Table 5.5 shows. This implies the availability of productivity, the scarcity of capital notwithstanding.

Table 5.5

Libyan trade surplus 1905-1910

Year	Exports	Imports	Trade surplus
1905	123,520	26,120	97,40
1906	158,040	22,800	135,24
1907	121,040	42,160	78,88
1908	128,840	27,040	101,80
1909	117,360	64,240	53,12
1910	176,000	128,000	48,00

Source: Zlitni [1972], p.17.

In its foreign trade, because of the poor economic conditions, Libya could not produce enough goods to meet the growing imports. This deficit in the trade balance was growing rapidly in the 1950s and in the early

1960s. Most of this was due to the increase in machinery and oil equipment imports used particularly by oil companies after the petroleum law of 1955. The table below (5.6) shows the growth of exports and imports during the 1950s. Exports were mainly agricultural goods such as groundnuts, almonds, esparta grass, olives and potatoes. Libya also exported livestock, and scrap metal which remained in Libya following the destruction of the Second War.

The balance of payments ran a heavy deficit from 1952 to 1959. The value of the Libyan imports of goods and services were nearly 50% of the value of its GNP. The World Bank report noted that this is "an extraordinarily high proportion matched by few other countries in the world" [Libyan University-London University Joint Research Project on Libya 1970 p.9]. Less than 20% of the foreign exchange proceeds necessary to pay these imports was obtained from the sale of Libyan merchandise exports. The remainder came from invisible exports, such as the military expenditures of foreign governments, and foreign aid. The unearned income was sufficient to cover the imports, and Libya was able to make additions of $25.2 million to her foreign exchange reserves.

5.1.5 Development planning:

The Libyan development plan in the 1950s had two advantages, which helped Libya to achieve a certain degrees of progress. The undertaking of the United Nations extensive resource survey, and the selection of the planning team according to the results of the resource survey.

A- The UN survey:

On the basis of the Mission Survey carried out in the early 1950s, the broad outline of a development plan could already be discerned in Libyan economic life. The survey made clear which sectors of the economy provided some hope of expansion and called for more intensive study. The planning

Table 5.6

Libya's Foreign Trade in (£L.000):1950-1960

Year	Imports		Exports	Re-exports	Trade Bal.
	Oil companies	Other			
1950	-	6,983	3,780	-	-3,203
1951	-	12,040	4,720	-	-7,320
1952	-	11,640	4,450	-	-7,190
1953	-	11,360	3,480	-	-8,880
1954	-	11,198	3,668	170	-7,360
1955	14,388		4,265	329	-9,794
1956	16,601		3,805	349	-12,447
1957	5,008	23,068	4,753	663	-22,660
1958	10,079	24,422	4,313	763	-29,425
1959	12,850	27,735	3,659	641	-36,285
1960	21,395	38,990	3,111	920	-56,357

Source: Bank of Libya, 1, [1967], Table 21.

team was composed of experts in each area of potential development. There were fifteen experts in all; included were a hydrologist, a war damage expert, a minerologist, a social welfare expert, a power engineer, a tanning expert, an expert on the cleaning, grading, and packing of wool, a fishing expert, and other FAO experts on dates, olives, animal husbandry, and citrus. Also participating were a public finance expert, a UNESCO team on general education, a WHO team on public health, a team on manpower training, with a chief economist to coordinate their work into a comprehensive plan [Higgins 1953 p.702].

The summary of the twenty four-year plan proposed by the mission, which had suggested three phases for development, is shown in Table 5.7. In phase one, a first six-year plan (1952-1957), emphasis was put on training and education, agricultural research, experiment, demonstration, and improvement. Agricultural production was to be increased by all possible means, including training of farmers, improvement of tools and techniques, and, when and where feasible, by expansion of cultivated acreage of individual farms and of the country as a whole. The role of repair of war damages, other public works, and public utilities was stressed. Net absorption of manpower into public development programmes was considered. Increased import surpluses, the large budget deficit, reliance on foreign financial and technical assistance were assessed. Capital accumulation of 5 to 10% of national income was taken as a target.

Table 5.7

Summary of the UN Proposed 24-year Development Plan for Libya

Phase	Main features	Capital accum.and savings
(1):1952-57	Emphasis was put on agriculture and training, repair of war damages, import surplus,budget deficit and reliance on foreign assistance.	5 to 10% of national income
(2):1957-69	Increased emphasis on agricul. processing and light industries, reduced import surplus, reduced budget deficits and reduced reliance on foreign grants.	10 to 15% of nat. income savings 10% of nat. income
(3):1969-75	Accelerated development of agri. and light industries, balanced trade, balanced budgets and independence of foreign aid.	at least 15% of nat.income at least 15% of nat.income

agri.= agriculture

nat. = national

In phase two were the second and third six-year plans. These placed increased emphasis on agricultural processing and similar light industries, for domestic markets, using domestic raw materials; the net release of manpower from the public development programme to the private industrial sector; reduced import surpluses, reduced budget deficits, and reduced reliance on foreign grants; capital accumulation of 10 to 15% of national income was targeted, the domestic savings of at least 10% of national income; reduced taxes and increased sales of consumer's goods were planned for.

In phase three were the fourth and subsequent six-year plans. These stressed the accelerated development of agricultural processing and similar light industries; balanced trade; balanced budgets independent of foreign financial and technical assistance; capital accumulation and domestic savings of at least 15% of national income was planned for.

The UN mission recommendations were taken into account by the regime, as the main source for planning, but the time period for each plan was different. In fact the mission did not expect oil exploration to be speeded up, as it was in actuality. The oil development increased the Government revenues and this in turn led to the revision of the development plans.

B- Development projects:

Among the government enterprises that were established (with technical assistance from the UN and the United States) were a date packing plant, a central milk pasteurisation plant, and the Tripolitanian Esparta Corporation. Esparta is a wild grass which grows on the mountains of South Tripolitania; it used to manufacture fine paper. This product is mainly collected for export, and some of it used to make handicraft products such as baskets. The latter organization has endeavored to assist small-scale private enterprise, which was most lacking in Libya, by granting £L10,000 credit to establish a handicrafts committee for promoting the production and sale of handicraft products.

For some years it was apparent that the Tripoli steam turbine electricity plant would have to be rehabilitated and expanded. SECI, an Italian company, owned the plant. The government did not want to leave it in the hands of the company, but lacked the capital needed for modernisation. The American grants made it possible to earmark £L1 million for this purpose.

The Libyan Finance Corporation (LFC) was slow in getting under way and it

never reached the scale recommended in the plan. At the end of 1954 it had total capital of £L100,000 and had made fifty three loans of three to five years, amounting to £L98,000. It should be clear, as mentioned earlier, that the lack of capital and private enterpreneurship had been one of the main obstacles to Libyan economic development. Very little genuinely Libyan private entrepreneurship appeared; the penchant for monopoly privileges continued to be a barrier. During the early part of 1957 the government was approached for grants of monopoly privileges in matches production, date processing, production of industrial alcohol, fisheries, and various agricultural ventures. By encouraging monopolisation the Government actually helped some private enterpreneurs to find their way and participate in economic development. Conversely it blocked the way for new national enterprises to take such a chance.

Foreign enterprise remained chiefly Italian. In the spring of 1955 the Libyan government finally reached an agreement with Italy regarding Italian residents and property, which included non-discrimination against Italian enterprises by the financial institutions. This agreement provided the basis for expansion of Italian enterprises, probably on account of the lack of capital and experience by domestic entrepreneurs.

At the same time, enactment of the Petroleum Law in June 1956 had led to active drilling by a number of foreign oil companies, the most important activity of non-Italian foreign enterprise in the country by far. The oil business became the main source of income following the commencement of oil exports in the early 1960s.

Such development as took place in the first five years (1952-1957) could never be financed domestically. There had to be another source of finance, foreign aid and foreign agreements. The strategic location of Libya in North Africa and near to the troubled Middle East, as I mentioned earlier,

had not only attracted the old powers in the world throughout the history as discussed earlier, but this position has also been of great importance to the modern powers of the globe. Towards the end of 1953, Libya concluded a long term (twenty-year) agreement with the United Kingdom to establish military bases in Libya, under which Britain promised £3,750,000 per year for 1952-57. Out of this, one million pounds per year was specifically earmarked for development projects. In July 1954 a similar agreement were signed between Libya and the United States of America in which the latter promised to pay $4 million per year for five years and a lower sum in the following years, plus $3 million in the fiscal year 1955 for specific projects (see Table 5.8 below). The US also provided 24,000 tons of wheat for relief and $1.5 million in technical assistance. The UN Technical Assistance Program amounted to $850,000. In 1954 France offered £100,000 for development and £163,000 for budgetary subventions. Italy and Turkey each granted £10,000 to the Development Agency. Moreover, since the agreement with the United Kingdom was made retroactive, total foreign aid in 1954-55 was running in excess of $26 million per year, or more than half the estimated national income.

Table 5.8

Foreign aid to Libya (in million ££$): 1954-1956

Source of aid	1954-55		1956	
	£	$	£	$
1.United Kingdom	9.500		5	
2.United States		8.500		12
3.United Nations		0.850		
4.France	0.263			
5.Italy	0.010			
6.Turkey	0.010			
Total	9.783	9.350	5	12

In 1956, both the British and the American grants were running at even higher rates. American assistance reached $12 million per year, of which $5 million was specifically earmarked for development (see Table 5.8 above). The budgetary subvention from the UK was raised by £250,000 in the fiscal year 1956 and by £750,000 in the following years. The sums earmarked for development alone exceeded 20% of national income. These grants were large only relative to the very low national income.

Although the financial problem looked as if it had been solved, large scale projects were still not possible in Libya, because of the lack of technical and managerial skills; entrepreneurship was a much more serious bottleneck than lack of capital. Part of the foreign grants was used by the government to establish important banks such as the National Bank of Libya, which took over the function of issuing currency from the Currency Commission in March 1957; also, the Agricultural Credit Bank, this was slow in getting under way, partly for lack of a co-operative movement through which the Bank could operate.

The changing structure of imports was a pointer to the changing structure

of the economy even before the actual discovery of oil. The share of capital and intermediate goods, which was for the use of oil companies, on the Libyan import list between 1954 and 1963 rose in terms of percentage and of total value. In 1954, these imports registered a total value of about £L5, or 43% of the total value of civil imports; in 1958, £L14 or 57% of the total value of civil imports. It was the discovery of oil which was responsible for the spectacular transformation of the Libyan economy after 1959.

Thus the pre-oil Libyan economy was no different from other developing economies in the world. Even though, the population was small compared to other less developed countries, there had been very little natural resources in use. Unlike Tunisia which has a relatively high proportion of agricultral land, or Egypt which is blessed with the Nile River, Libyan cultivated land was no more than 1% of the total area with no natural rivers whatsoever. The lack of capital investment and know how made exploitation of potential resources a dream in the back of the Libyan minds. Again, the location of Libya, as well as the prospect of discovering oil, attracted foreigners to Libya. This time not the old invaders but the well funded and technically advanced oil companies. This matter will be discussed next.

5.2 The emergence of the petroleum sector:

In this section I analyse the development of the Libyan oil sector since the promulgation of the Petroleum Law in 1955. The development of oil in Libya was, to a great extent, an exception as far as Libyan industry is concerned. It developed so quickly that the distinctions between different stages of production from exploration to marketing can hardly be observed.

The possibilities of oil in Libya, and the permisiveness of the Petroleum Law were the main attractions for oil companies to explore for oil in

Libya. This law was designed by American oil companies to serve their own interests. It allowed the concessionaires to deduct large charges on all physical assets acquired before production, and did not tie Libyan oil royalties to the posted price, as was the case in the Middle East. These favourable conditions made it attractive for international oil companies (majors and independents) to compete for Libyan oil. This competition has had serious effects on the oil companies, the Libyan economy and the world oil market. Some of these effects will be discussed in the next chapter.

Soon after oil was discovered, the companies built pipelines through the Libyan desert, oil ports and terminals on the coast, construction and gathering facilities, etc.. The result of this intense activity in the oil industry was a huge increase in Libyan crude production, which was unprecedented over such a short time. Accordingly oil revenues became so large that the underdeveloped Libyan economy could not absorb them. These developments were the main sources of power which made the Libyan Government's bargaining with the oil companies in early 1970s not only possible but likely to be successful. The terms of the Petroleum Law and the acceleration of oil discoveries and exports will be discussed next.

5.2.1 The Petroleum Law:

There are three factors which together worked as incentives to oil exploration in Libya. First, the presumed geological history of Libya. Second, the increased demand for oil following rapid industrial expansion after the Second World War; and third, the similarity between the geographical context of Libya and Saudi Arabia, Kuwait and Algeria which were oil producers in the 1950s.

When the Mineral Law was promulgated in 1953, nine international petroleum companies started preliminary geological reconnaissance in Libya by paying a fee of £L500 for a year, renewable annually, for every

reconnaissance permit. Most of these companies were majors such as Esso Standard, Mobil and Shell [Mosley 1973 p.261], and the remaining were independents such as Amerada, Continental and Bunker Hunt.

Libya was uncertain as to how to go about granting concessions. The King's ministers were told by their foreign advisers, none of whom were oil experts, that they should at once set about writing a general petroleum law, defining the terms under which the concessions would be granted. The Libyans were by this time extremely anxious to see their potential petroleum wealth turned into hard cash, and they were therefore most grateful when the American oil companies offered to speed things up for them by loaning legal experts from their organizations and helping them to draft a petroleum law that would enable operations to go ahead. As a result, the Libyan Petroleum Law of 1955 looked like an equitable piece of legislation that would benefit both parties to any concession agreement, and at a quick glance its provisions did not seem different from those of the old Middle East concessions. Profits from the concessions would be subject to a tax of 50%, and a royalty of 12.5% on every barrel of oil would be traded as a partial payment of the tax on profits. But the Libyans were to discover that they also accepted some fine print, the significance of which they did not appreciate until it began to affect them. Written into the Law by the American experts were two provisions which were especially favourable to their operations:

The first was a depreciation allowance, which allowed the concessionaires to deduct a charge of 20% on all physical assets acquired before production. (They also had a choice of a 20% amortization of all their expenditures before production began, or a depletion allowance of 25% of their gross income).

The second provision tied Libyan oil royalties not to the posted price,

as in the rest of the Middle East, but to the price which the oil secured on the market.

The moment the new law was promulgated the rush began. The reason for this rush by international oil companies can be summarised as follows:

A- The proximity of Libya in relation to Europe provided a chance none of the oil companies wished to miss.

B- The major oil companies, which were eager to find a west of Suez oil resource, especially after the closure of the Canal in 1956, thus Libya was an important opportunity.

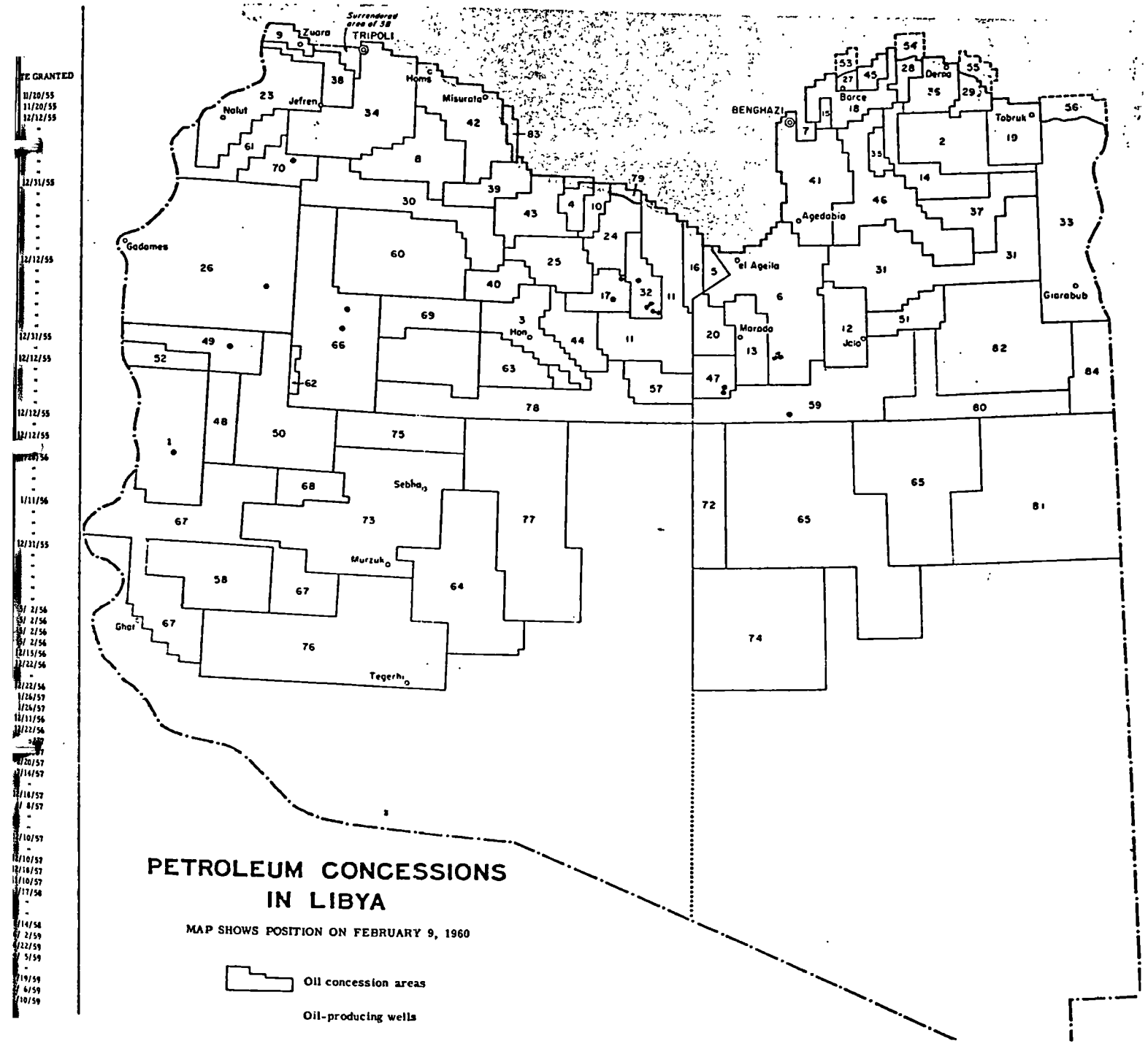
C- The independent companies, which had competed with the majors in oil refining, wanted to have their own sources of crude oil instead of continuing to rely on the majors for it.

D- The producing oil companies also wanted to diversify their resources.

The terms of the Petroleum Law had made operations especially attractive to independent oil companies, for the lack of a posted price provision meant that they could sell Libyan oil at cut rates and thus obtain an advantage in markets still largely controlled by the major companies.

The 1955 Law divided Libya into four zones for the purpose of allocating concessions corresponding in areas to the three provinces of Tripolitania (zone 1), Cyrenaica (north-zone 2, and south of the 28^{o} parallel-zone 3) and the Fezzan (zone 4)(see Map 5.1). There was no significance in this zoning other than to achieve a correspondence with the three provinces, and the fact that the remoter zones 3 and 4 carried lower rents and lower minimum working obligations. Article 7 noted that applications for concessions were to conform as far as possible to the grid lines of the official Map, and each concessionaire was to be limited to a maximum of three concessions in each of the first and second zones and four in the third and fourth zones [Nafa 1976 p.271]. The total area allocated to any

Map (5.1)



Source: International Bank for Reconstruction and Development, (1960), p.60

one concessionaire should be limited to 30,000 square kilometres in each of zones 1 and 2, and to 80,000 km^2 in each of zones 3 and 4 [The Libyan Petroleum Law, 1955, Article 9].

Concessions were granted for a period of 50 years, and were renewable for a further period of 10 years, making 60 years the maximum period for which they might be held. 77 concessions were granted to 14 companies between 1955 and 1958, increased to 84 concessions by the end of 1959 (see Table 5.9 and Map 5.1). Many of the companies concerned were affiliates of Major and Independent oil firms. Up to this stage 55% of Libyan territory was covered by the concessions. The number of concessions had increased to 95 by the end of 1961, and to 136 in 1966. At the end of 1967, there were 42 concession-holders in Libya of which 22 were American companies, and 20 were Western European companies [Knapp 1977 p.210].

There were two Articles in the Petroleum Law designed to stimulate concession-holders to vigorous exploration activity. Article 9 required a bond or banker's guarantee of £L50,000 throughout the life of a concession, to secure the "*due performance of the concession-holder's obligations under all concessions held by him in Libya*". This may have had some effect in deterring applications of a purely speculative nature. Article 10 required concession-holders to surrender 25% of the area of a concession within five years from the date of the original grant, 50% within eight years and 66 2/3% in the first and second zones within ten years, and 75% in the third and fourth zones. This provision, which had become normal practice in the granting of concessions by other countries (though varying in percentages and periods), proved to be an effective encouragement to industrious exploration. The oil companies, being concerned not to surrender an area subsequently found fruitful, strove to cover the whole of their concession by survey at least, and the more promising parts by wild-cat drilling

Table 5.9

List of Oil Concessions in Libya up to 1959

Concession	Company	Date Granted
1	Esso Standard (Libya)*	11.20.55
2	Nelson Bunker Hunt	11.20.55
3-8	Esso Standard (Libya)*	12.12.55
9-15	Mobil Oil of Canada LTD*	12.31.55
16-22	Libyan-American Oil Co.	12.12.55
23,24	Compagnie des Petroles Total(Libya)	12.31.55
25-29	Amerada Petroleum Co.(Libya)	12.12.55
30,31	Continental Oil Co.(Libya)	12.12.55
32,33	Oasis Oil Co.	12.12.55
34-37	BP Exploration Co.(Libya)*	1.28.56
38-41	Libya Shell N.V.*	1.11.56
42-47	Texaco Overseas/California Asiatic*	12.31.55
48	Esso Standard (Libya)*	5.02.56
49	Campagnie Des Petroles Total(Libya)	5.02.56
50	Mobil Oil of Canada LTD*	5.02.56
51	Texaco Overseas/Cal. Asiatic*	5.02.56
52	Libya Shell N.V.*	12.15.56
53,54	Continental Oil Co.	12.22.56
55	Oasis Oil Co.	12.22.56
56	Oasis Oil Co.	1.26.57
57	Mobil Oil of Canada LTD*	1.26.57
58	Esso Standard (Libya)*	12.11.56
59	Amerada Petroleum Co.of Libya	12.22.56

Table 5.9 continue

Concession	Company	Date Granted
60	Oasis Oil Co.	1.26.57
61	Campagnie Des Petroles Total(Libya)	3.04.57
62	Mobil Oil of Canada LTD*	2.20.57
63,64	BP Exploration Co. (Libya)*	7.14.57
65	Nelson Bunker Hunt	12.18.57
66-68	Gulf Oil Co. of Libya*	4.08.57
69,70	Libya Shell N.V.*	12.10.57
71	Amerada Petroleum Co. of Libya	12.10.57
72	Mobil Oil of Canada LTD*	12.18.57
73	Texaco Overseas/Cal. Asiatic*	11.10.57
74-76	Pan American Oil Co.	3.17.58
77	D.E.A./Wiag	8.14.58
78	Elwerath	6.02.59
79	Gulf Oil Co. of Libya*	8.22.59
80,81	BP Exploration Co. (Libya)*	9.05.59
82	C.O.R.L.	11.19.59
83	Texaco Overseas/Cal. Asiatic*	12.06.59
84	Pan American Libya Oil Co.	12.10.59

(*) Major oil companies.

Source: International Bank for Reconstruction and Development [1960], p.60.

before being called upon to choose areas for surrender. Article 10 also contained provisions for minimum working obligations, designed to ensure that a company did not obtain a concession and leave it idle. This might occur even in the case of a major enterprise, if it suited the company's world-wide development and supply planning to leave an acquisition for examination and development at a future date. However, there was also a danger that unscrupulous operators, having surmounted the competence test for award of concessions, might obtain them for speculative purposes, hoping to assign or sell out at a gain subsequently without themselves having performed, or having the capability to perform, exploration and development work. To forestall such action Article 17 of the Law required the Commission's consent to assignment of concessions other than to affiliates of the concession-holder. The minimum working obligations are shown in Table 5.10.

Table 5.10

Minimum Working Obligations

Zone/Period	Zones 1,2 £L(skm/year)	Zones3,4 £L(skm/year)
During the first 5 years	1.5	1.5
During the next 3 years	3.5	1.5
Subsequently	6	3.5

Source: Waddams [1980], p.62.

This law was an important event for two reasons. First, it enabled a large number of oil companies to engage in the systematic exploration of large tracts of land, an activity which soon rewarded both the country and the companies with significant oil finds. Second, the law departed from the usual system of concession-granting in the Middle East which usually leads to the establishment of a single concessionaire in the exporting country, e.g Aramco in Saudi Arabia, Anglo-Iranian in Iran. Libya departed

from the control of the Majors because it wanted fast exploration and development at a time of plentiful oil supply. The law provided an opportunity to the Independents to enter an area hitherto denied to them. The Independents, such as Occidental, Amerada, Continental and Marathon are petroleum companies which competed with the Majors in the oil product markets but did not control many sources of crude petroleum. The competition between the Majors and Independents was rightly thought to be the appropriate method.

According to testimony in a private civil suit by Mustafa Halim, King Idris's Prime Minister, concessions were awarded in such a way as to avoid making the country overly dependent on the "*Seven Sisters*", which might subordinate the promotion of Libyan output to their much larger interests in the Arab Gulf and the avoidance of a surplus in world markets: "*I did not want Libya to begin as Iraq or as Saudi Arabia or as Kuwait, I did not want my country to be in the hands of one oil company*" [Blair 1976 p.211]. Instead, special consideration was given to independent companies which, lacking concessions elsewhere, would stand or fall by their success in Libya: "*We wanted to discover oil quickly. This was why we preferred independents in the first stage, because they had very little interests in the Eastern hamisphere outside Libya*" [Blair 1976]. As a result, Libya led all other OPEC countries in the proportion of its output produced by independents. In 1970, independents produced 55% of Libya's crude output, compared to an average of 15% for all OPEC countries. These Independents were reliant on oil supplies in Libya, and were fairly vulnerable to pressures exerted by the host government, while the majors enjoyed diversification of sources. This point was the first of a series of significant events which changed the environment of the oil market, at the time of Libyan negotiations with oil companies. As will be argued in

Chapter 7, these events worked in favour of Libya and OPEC.

It is clear from the way the 1955 Petroleum Law was drafted, the response of oil companies to its inducement revealed that its provisions were too generous, as discussed above. In November 1957, the Libyan government began to insist on better terms in negotiating the granting of new concessions. Allowances were reduced in 1958, agreements completely eliminated in subsequent contracts, and new concessionaires were requested to pay a bonus from 1959. The concessionaires were requested to spend a fixed minimum amount on exploration over a specified period of time. This principle had not been required in the old Middle East concessions, but has since gained wide currency in Libya.

The amendment of the 1955 law on July 3, 1961, defined certain concepts, such as company profits, reference prices for tax purposes, allowable expenses, with much greater precision than hitherto. Libya allowed sales and marketing discount practices, in which companies with access to Libyan oil enjoyed clear advantages over other competitors which were not as near as Libya to the European markets.

5.2.2 Oil production and facilities:

The story of oil discoveries in Libya is a long and interesting one. I shall not retell it here, but rather briefly state the major events which have had significant effects on the development of the Libyan oil industry. It is also worth stating here that the search for oil in Libya was not in the interest of Libyans only, but also in the interests of foreign oil companies and foreign powers. European countries such as Italy, France, the UK, the United States and the USSR, all had thought there might be oil in Libya, especially when oil was discovered in the Algerian Sahara, which is an extension of the great Libyan desert. Libya, I think, might not have been granted independence so swiftly if oil had already been discovered in

its soil.

Because oil had already been found in Algeria (one field was almost on the Libyan frontier) western Fezzan the first main centre of interest. Esso Libya spent a year on geological and geophysical exploration in Concession One, between the Ubari Sand Sea and the Algerian frontier. In June 1957 Esso decided to drill. In January 1958 came proof that there was oil in Fezzan, when Atshan Number Two well started flowing at the rate of 500 barrels per day (b/d), but its low output was not worth exploiting. Early in 1958 Esso started drilling in its 10,000 square-mile Concession 6, which stretched southwards from the Gulf of Sirte to Gabel Zelton. Despite extensive exploration and drilling costing £24 million in 1958, not one commercial find had been made by the end of the year [Wright 1969 p.247].

The search continued in 1959, which was the year when success was achieved. A promising well was found at Bir Zelten. Zelten Number One flowed at 17,500 b/d, a rate that compared favourably with Saudi Arabian and Kuwaiti oil wells. At less than 6,000 feet Zelten Number 2 was brought in at 15,000 b/d. New promising wells were discovered in 1958 and 1959 as summarized in Table 5.11.

In May 1965 the Libyan Government invited offers for some new concessions. They were composed partly of acreage not previously assigned and partly of territory handed back under the clause in the Petroleum Law requiring concession-holders to relinquish 25% of their holding five years after its being granted. In February 1966 allocations were announced, and two concessions, 102 and 103, went to Occidental of Libya INC (OXY). The findings of this company proved to be significant, and the fact that it had no other discoveries other than in Libya proved to be crucial, not only for its future and other companies' futures, but for the future of the whole industry; this was important in the shift of oil power from the

Table 5.11

Summary of Petroleum Discoveries: 1958-1959

Company	Field name	Completion date	Prod.(b/d	Gravity	Depth
Esso Standard	El Atshan	20 Jan.1958	508	44.5	2,200
Oasis	El Bahi	27 Jul.1958	500	39.0	5,840
C.P.T.L.	Oued Tahara	26 Dec.1958	100	45.0	4,580
Oasis	Dahra	30 Apr.1959	1,061	41.0	3,200
Esso Standard	Zelten	13 Jun.1959	17,500	37.0	5,500
Esso Sirte	Mabruk	30 Jul.1959	500	40.0	5,700
Gulf	Emgaget	7 Sep.1959	888	37.9	4,100
Amoseas	Beida	26 Sep.1959	3,650	36.6	4,000
Shell	Bir Tlacsin	30 Oct.1959	700	44.0	8,900
Mobil	Amal	1 Nov.1959	990	34.0	9,900
Oasis	Dahra B.	14 Nov.1959	36	43.5	2,800
Oasis	Waha	27 Dec.1959	226	21.6	1,500

Source: Farley [1971], p.123.

monopolisation companies to OPEC The role of Occidental (OXY) in these oil market changes will be elaborated in Chapter 7. Meanwhile, within fifteen days of the award, Occidental had started seismic operations in Concession 102. By the end of April 1967 seven Augila wells of OXY were between them producing 61,000 b/d. This was just the start of OXY's successful operation in Libya. In concession 103, the A_1 wildcat drilled about 40 miles west of Augila came in at a magnificent 40,080 b/d in May 1967. The A_2 well came in at 53,349 b/d, and A_3 at only 2,000 b/d less than A_2. Drilling and exploration activities continued throughout 1960s and 1970s as Table 5.12 shows. The reduction in the number of rigs in the early 1970s (shown in the Table 5.12) followed by a reduction in the number of completed wells, reflected the change in Libyan oil policy, which was marked by conservation in the 1970s. The trend also reflected the relationship between the Libyan Government and the oil companies after the September revolution in 1969 [Allan 1982 p.40].

Transportation facilities and terminals:

Except for the new off-shore discoveries near Zuara in Libyan- Tunisian waters, which have been, until recently in dispute between the two countries, most of the oil fields are deep in the desert. Mabruk or Nafora fields are only about 35 miles from the terminals. The farthest of all is Sarir field of BP, at about 320 miles from the terminals. Map 5.2 shows the locations of these fields; it also shows oil and gas pipelines and exporting terminals on the coast, as well as medical, commercial, and social facilities.

Within twenty-nine months of first striking oil at Zelten, the first crude oil to be exported from Libya was shipped off from Marsa al Brega. In June 1960, following hydrological surveys, Marsa al Brega was selected as the most appropriate location for an oil port and terminal. Marsa al

Table 5.12

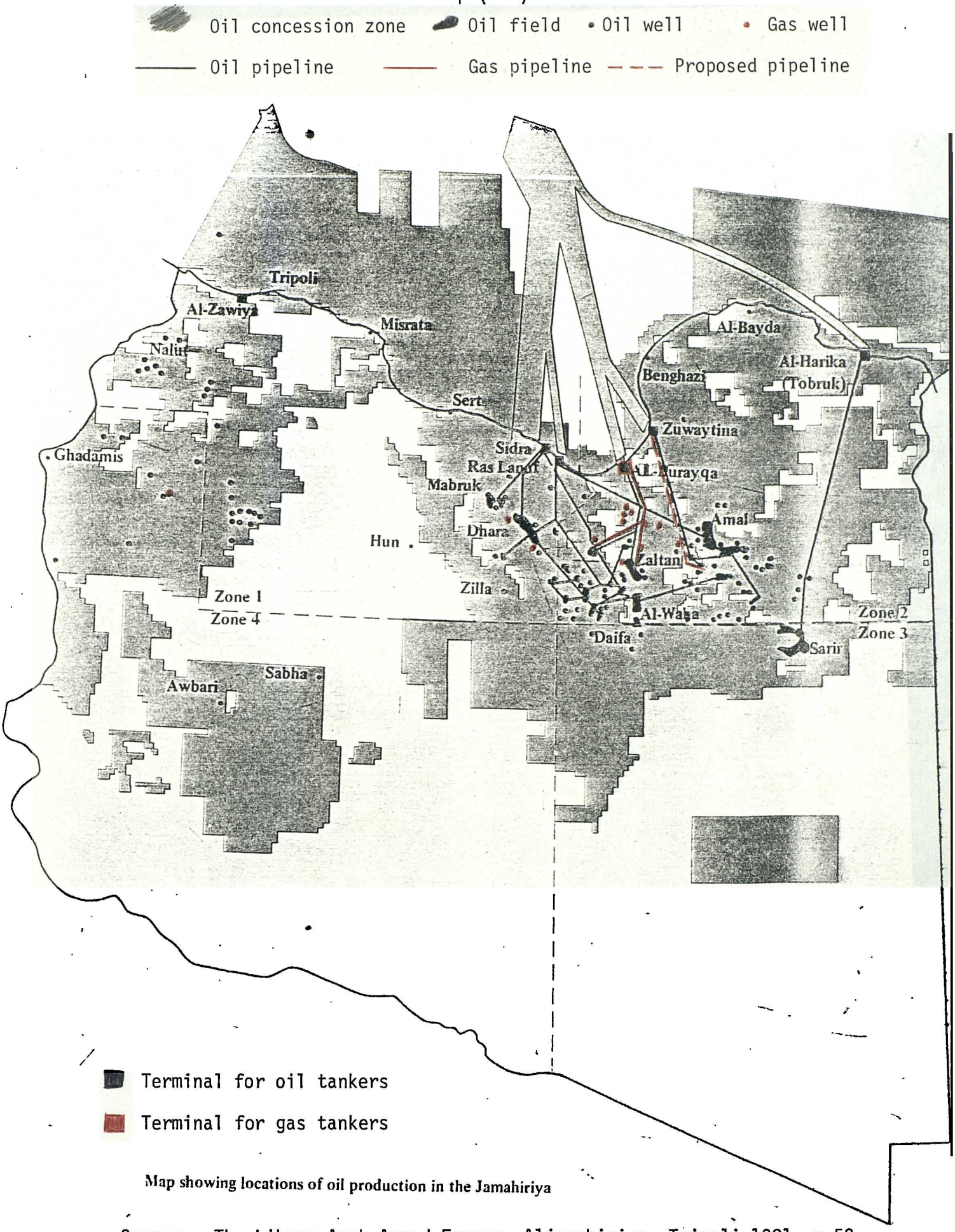
Oil Activities in Libya: 1963-1980

Year	No.of companies		No.of Wells				No.of Rigs
	Producing	Non prod.	Oil	Gas	Dry	Total	
1963	7	16	440	8	546	994	46
1964	10	15	657	14	743	1414	45
1965	12	10	820	18	878	1716	55
1966	14	27	1006	15	933	1954	21
1967	16	27	1086	19	983	2088	22
1968	17	22	1164	20	1074	2238	37
1969	21	23	1316	24	1133	2473	55
1970	21	22	1487	27	1204	2718	13
1971	20	14	1529	27	1243	2799	18
1972	20	11	1553	27	1274	2854	9
1973	21	15	1600	27	1309	2936	8
1974	21	--	1646	28	1334	3008	14
1975	19	2	1679	29	1384	3092	9
1976	19	--	1729	29	1424	3180	18
1977	19	--	1827	31	1458	3316	22
1978	13	6	1935	31	1585	3451	27
1979	--	--	2093	33	1545	3671	32
1980	--	--	2218	33	1591	3842	22

(--) Not available.

Source: Central Bank of Libya, [1980], p.86.

Map (5.2)



Map showing locations of oil production in the Jamahiriya

Source: The Libyan Arab Armed Forces, Aljamahiriya, Tripoli 1981, p.52.

Brega, besides being 800 km. from Tripoli and 250 km. from Benghazi, was also 175 km. from Esso's Zelten field in the desert. Following the selection of Marsa al Brega a contract for a 105-mile, 30-inch pipeline from Zelten to Brega was awarded, and in July the first shiploads of 40 foot lengths of pipe began arriving off the terminal site [Kubbah 1964]. As there were no harbour facilities, the pipes, which had been plugged at both ends, were floated into the sea, towed to land by boats, and man-handled ashore. By August 1961 nearly 16,000 sections of pipe had been welded, wrapped, and buried to form the complete pipeline; an asphalt road parallel to the pipline was also completed. Smaller fields at Riah and Jabal were tied into the pipeline system later. Originaly the pipeline had a capacity of some 200,000 b/d. Pumping equipment had to be added to enlarge that capacity by 1965 to 605,000 b/d. Table 5.13 indicates that both oil and gas production from the Zelten field increased nearly 25 times between 1961 and 1964, which forced the company to increase the pipeline capacity.

Table 5.13

Production of Zelten Oil Fields (1961-1964)

Year	Oil production in barrels	Associated Gas in(000)cubic feet
1961	6,641,886	4,250,807
1962	46,012,020	29,341,533
1963	91,262,136	58,730,136
1964	149,259,417	100,847,567

Source: Farley [1971], p.120.

During the same period, an aircraft landing strip was constructed at Brega, trailer housing to accommodate some 60 people was brought in, and a surge tank and maintenance facilities set up. Simultaneously, the harbour was dredged and a wharf and a breakwater completed, fourteen 2,200ton

caissons, built of concrete and each in one piece, being sunk into the dredged channels to complete an L-shaped wharf and breakwater. A second breakwater, built of sand-filled steel cells, was added to the first, and mooring berths were constructed off-shore with connecting feeder lines. Other buildings and facilities were constructed, such as storage tanks, meter batteries to measure the oil loaded onto the tankers, on-shore roads, offices, warehouse and maintenance buildings.

Between 1961 and 1964 the number of producing wells in the Zelten field increased from 3 to 43, with an average flow of some 500,000 b/d. This expansion in turn resulted in the construction of an additional pipeline along the road to Marsa al Brega as part of a water injection project to keep up the field's pressure, a 100% increase in the capacity of the gas-oil separation plant, expansion of the flow lines and gathering units, and the construction of permanent air-conditioned housing and a new airstrip.

The Oasis Oil Company began production in 1962. Crude oil was drawn from the Gialo, Defa, Dahra and Bahi oil fields via an 850 km. trunkline of one million b/d capacity to the Sidrah oil terminal. A point of interest is that the line passes through the Beida Field of Amoseas Concession 47, making it possible for the latter company to use any surplus capacity in the pipeline for exporting its production from Sidrah Terminal.

Mobil-Gelsenberg production was concentrated in the Amal Field in Concession 12 and linked via a 282 km. pipeline to Ras-Lanuf terminal, while the Hofra and Ora fields led to the same export point through a 160 km. line. Nafora oil field of Amoseas used a parallel 52 km. line to join Mobil's Amal Raslanuf pipeline.

Sarir Field of BP was further from the coast than any other productive field. Marsa Hariga on the Gulf of Bomba at Tobruk was selected as a

terminal port. Marsa Hariga stands on a deep-water bay forming probably the best natural harbour in Libya. Loading could continue there during spells of rough weather that frequently held up operations at the Gulf of Sirte terminals. The water was deep enough to allow tankers to moor close inshore and load from surface pipelines. This feature helped in handling the waxy Sarir crude, which had to be heated before it would flow. In 1965 BP started work on Marsa Hariga project by laying a 320-mile, 34-inch pipeline, part of it through the great Sand Sea of Calancio; this was finished at the end of 1966. By then some seventy wells were ready to start feeding oil into the pipeline, which had an initial capacity of 100,000 b/d. On January 1967 the first shipment of Sarir crude left Marsa Hariga. The cost of pipeline and terminals was approximately £m35.

In the space of about ten months, Occidental built a 135-mile, 40-inch pipeline with a capacity of one million b/d from the Idris Field to Zuetina, on the Gulf of Sirte near Agedabia. A 24-inch spur-line brought in Augila crude, and production started in February 1968 at 150,000 b/d. Late in 1967 Occidental brought in the D_1 well, 15 miles south of the Idris Field, with an enormous flow of 74,867 b/d, and a 40-inch spur-line was built to link this find with the main Zuetina pipeline.

Fees, rents, royalties and taxation:

The fee payable on grant of concession was, as mentioned earlier, £L500, and the rents are shown in Table 5.14 below. These provisions contained

Table 5.14

Libyan Concession Rents

Zone/Period	Zones 1,2 £L(100skm/year)	Zones 3,4 £L(100skm/year)
First 8 years	10	5
Next 7 years or until oil is found in commercial quantities	20	10
Thereafter	2,500	2,500

Source: Waddams [1980], p.63.

an ambiguity, which was corrected in the 1961 amendment to the law. It was intended that the high rent of £L2,500 should apply immediately on the discovery of petroleum in commercial quantities, whenever that took place, but the wording of the original law applied this only to the period after the eighth year. The object of this greatly increased rent was to stimulate a concessionaire into fast development of discovered oil and not to leave it undeveloped. In fact it turned out to be ineffective, since there was no objective criterion or definition of "*commercial quantities*". The higher rent was thus charged only after a company had begun development.

A royalty of 12.5% of its value "*on the field*" was to be paid on crude oil, gas and natural gasoline, both after deduction of those quantities used by the company in its operations of producing the oil and transporting it to seaboard terminal. The value of the oil and gas for calculating the royalty was to be based on the "*free competitive market price*" F.O.B. at the seaboard, from which were to be deducted the handling charges and costs of transportation from field storage. Of course the cost of moving oil from BP's Sarir field, 320 miles, to Marsa Hariga on the coast, is not

comparable to Amoseas Ras-lanuf just 52 km. pipeline. However, there was to be no free competitive market price for crude oil at the seaboard terminal as virtually all the oil to be produced in Libya was transferred to the producing companies' affiliates at a price decided by the companies themselves. Neither was there any published market price which was 'free and competitive at any seaboard terminal outside Libya, either nearest or elsewhere in the world. Hence these royalty definitions in respect of crude oil were, to say the least, imprecise. When the profit-sharing principle became more widely accepted, royalty came to be regarded, whatever its level, as a contribution to the Government's share of the profits of the concessionaire, and hence was confused with taxes on profits.

Article 14 of the Petroleum Law required the concession-holder to pay income taxes and other taxes and imposts payable under the laws of Libya, and in addition a surtax which made the total of these payments equal to 50% of the profits [Waddams 1980 p.65]. Fees, rents and royalties paid were regarded as advance payments of the profit to which the Government was entitled. The fees, rents, royalties and surtax were to be paid to the Petroleum Commission. The other taxes and imposts, mostly customs duties, stamp taxes and vehicle licence levies, were to be paid as they were incurred, to the appropriate government authority. If all of these payments combined exceeded the company's libilities to the Commission (for rents, fees, royalties and surtax) the excess was to be carried forward and deducted from payments to the Commission due in the following year or years.

The Law defined profits as "*the income of the concession holder obtained from all his petroleum exploration, prospecting, mining and producing activities in Libya after deducting allowable costs and expenses*" [The

Petroleum Law. Article 14]. Exploration and prospecting expenses and intangible drilling costs might be deducted in the year in which they were incurred, or capitalised and amortised at a rate of 20% per year, at the option of the concession-holder, and of those acquired after production had begun at 10% per year. There was also a depletion allowance introduced into the 1955 law. This allowed a deduction from taxable income of 25% of gross income derived from operations up to a maximum of 50% of net income. In lieu of depletion allowance the concession-holder might amortize his intangible pre-production exploration expenditure at 20% per year.

The calculation of the profits which were to be equally divided between Government and company is crucial. In this respect, the Libyan Law was imprecise in the definition of income and permissive in that of costs and expenses allowed to be set against income in order to identify the taxable profit. The definition of income indeed confines itself because it pays no heed to the fact that such an income from exports of crude oil, by the majors at least, is never identifiable. The oil exported by the major international oil companies is transferred to affiliates, which transport it overseas and sell it to other affiliates in consuming countries where, mixed with crudes from other sources, it is refined, distributed and sold as oil products and chemical and other feedstocks. The oil company, even by the most sophisticated accounting methods, is unable to identify the profits attributable to operations in Libya contained in sales of final products jointly refined from blended crudes from many sources. But there is no profit realised at all until the processed oil is sold as petrol, the kerosene, or fuel oil to the final consumer. The interpretation of the definition of income in the 1955 Law was imprecise, and it was not until 1965 that a tightly worded definition of the value of crude oil exported, in unequivocal terms of posted prices, was to be effective. However,

Government revenues are still calculated in terms of fees, rents, royalties and taxes, even after the participation/nationalisation movement during the first half of 1970s, e.g. in 1978 the different components of the Government oil revenues was as shown in Table 5.15 below.

Table 5.15

Government Oil Revenues in 1978

Item	(000)Libyan Dinars	Percentage
Royalties	547,053	25.16
Surtax and income tax	1,607,170	73.90
Rents of concessions	17,089	0.79
Vehicle licence levies	127	0.01
Stamp taxes	487	0.02
Other	2,677	0.12
Total	2,174,603	100.00
Payment from 1977	617,129	
Grand total	2,791,732	

Source: Ministry of planning [1979], pp.24 and 25.

Thus the weakness of the 1955 Petroleum Law formed the strong base for accelerating the search for oil in Libya, by the competition between Major and Independent companies. The intensive exploration resulted in series discoveries which followed by building of pipelines, terminals, and other facilities. Upstream operations were speeded up to satisfy the desires of both the Libyan Government and the oil companies. This development, which will be discussed in the next section, proved to be of great importance to Government-company relationships, in that the Government not only insisted on a higher share of per barrel profits and prices, but also on the partial and in some cases complete ownership of the oil companies' Libyan facilities.

Natural gas development:

While successive Libyan governments in the 1960s were content to allow the rapid exploration of oil reserves, they were slow to insist on measures to prevent the waste of natural gas produced in association with oil. Unless a local or foreign market is found for it, such natural gas must be flared (burnt) at the oil field, except for that part used by the companies in their own operations. In addition to associated gas there were several gas fields discovered. These were plugged and the fields abandoned. Of these the most notable were Concessions numbers 6 and 20 of Esso, which were eventually used by the great gas liquefaction plant constructed at Marsa al Brega and completed towards the end of 1968. Others fields with substantial gas production were discovered by Libyan Atlantic off-shore in Concession 88, Gulf in 66, Oasis in 26 and CPTL in 23, all in western Libya; Mobil in 72 zone 3 in the far south; and Pan-American (Amoco) in 95. None of these fields were developed [Wright 1981 p.234]. By 1962 there was an estimated 30 billion cubic metres of associated natural gas in Zelten field alone, and more in the other fields. In 1964 Algeria started the first successful commercial shipments of natural gas in frozen, liquefied form to Britain and France, and Esso announced plans for similar exports of Zelten gas. In November 1965 the company signed contracts for the supply of liquefied natural gas (LNG) to Italy and Spain and started building a $300 million gas liquefaction plant at Marsa Brega. In this process the gas is frozen to minus 161 degrees centigrade and then shipped as a liquid in purpose built tankers to a receiving terminal, where the frozen liquid is regasified for commercial use. The project was described as the largest single investment that the parent company had ever made, and at the start of construction the largest such plant in the world [Waddams 1980 p.199]. It was begun in 1965 for completion in 1968, when its initial capacity

would be 345 million cubic feet of gas a day. The main pipeline was a 175 km. 36-inch unit from Zelten (now Nassar) field, which was originally planned to carry seawater to the fields as part of a subsequently abandoned oilfield re-injection programme. A second supply was taken from the Raguba field via a 98km. 20/22-inch spur and further sources of natural gas were available from fields owned by Oasis and Amoseas through a pipeline feeding into the Zelten system.

All of this construction had to be completed prior to the export of crude. In fact, the high speed of these operations was intended to speed up the shipments of crude abroad. The increase in production and exports resulted in the increase of Libya's oil revenues and the companies' profits.

Crude production and Government revenues:

By the time its pipeline construction and other facilities were completed, Esso announced the start of exports. Zelten crude was the first Libyan oil to be produced and exported. Zelten production started on 8 August 1961. Half a million barrels of oil were pumped before the pipeline filled completely, and not until 17 August did oil begin to reach Marsa al Brega. On 12 September 1961, fifteen months after the start of work on the Zelten-Brega transportation system, the first oil was shipped from Libya. Total exports in 1961 amounted to 6,670,000 barrels. Esso's achievement was duly acknowledged on 25 October when the Marsa al Brega terminal was officially inaugurated by King Idris. Esso exports had been flowing for less than a year when in May 1962, oil started moving along an 85-mile, 30-inch pipeline from the Oasis group's Bahi and Dahra Fields in Concession 32 to Es Sidra terminal, 100 miles west of Marsa al Brega road.

Libyan production increased rapidly in the 1960s, and by 1966 Libya was already the fourth largest producer in the Middle East/North Africa region,

accounting for more than 12% of production in the region. Libya became the third largest producer in 1968, increasing its share to 21.8%, and in 1969, for a passing moment, it was the second largest producer slightly ahead of Saudi Arabia (excluding output from the Neutral Zone) and surpassed only by Iran. The Libyan share of regional production peaked then at 23,6%.See Table 5.16.

Table 5.16

Libya, Middle East and World Crude Oil Production: 1966-70.

(in million tons)

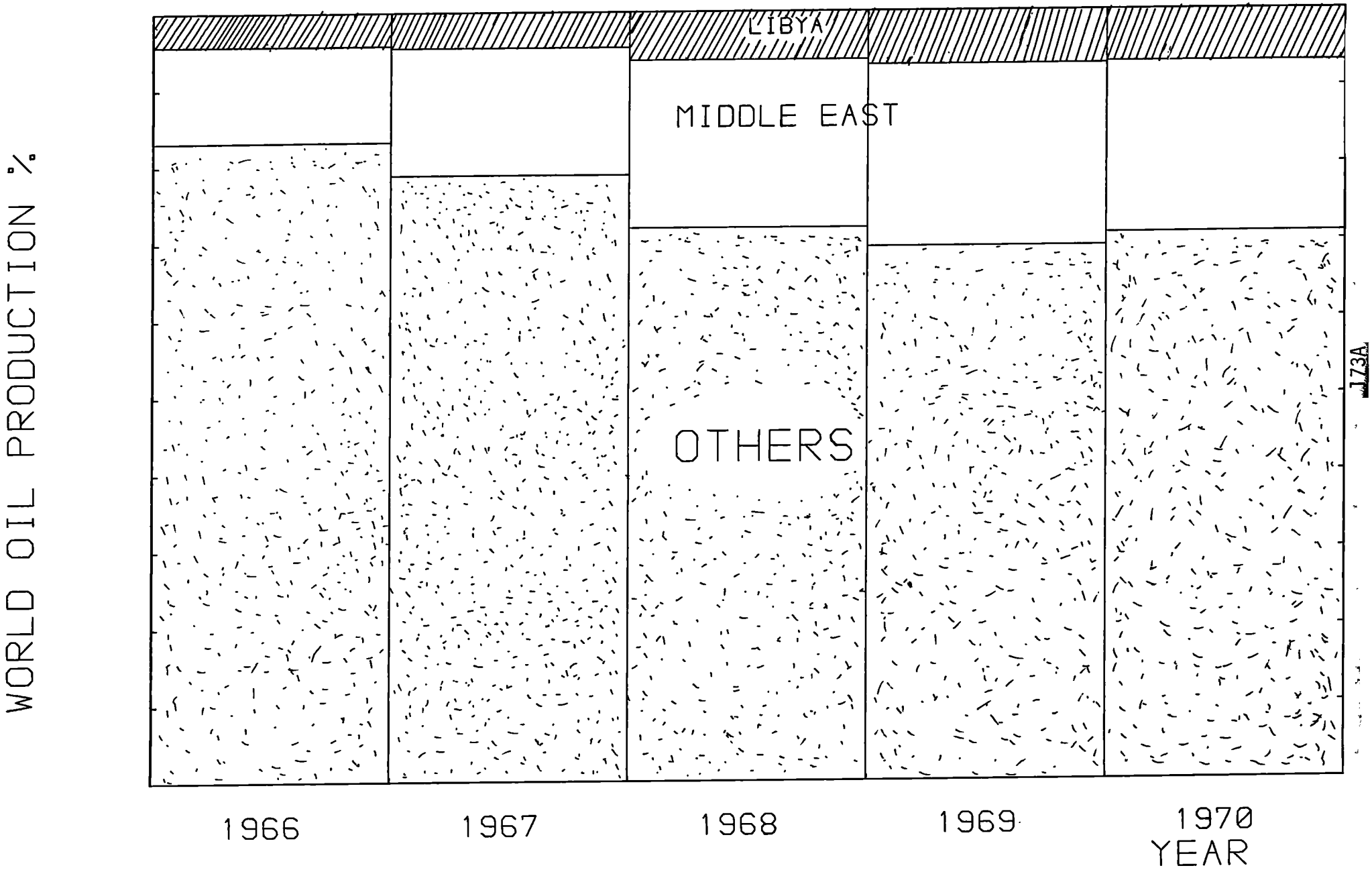
YEAR	Libya (%)	Middle East (%)	World
1966	73 4.3	576 12.6	1710
1967	84 4.6	506 16.6	1832
1968	125 6.3	573 21.8	2001
1969	150 7.0	634 23.6	2135
1970	158 6.8	712 22.2	2334

Source: Ministry of Planning [1971], p.4.

At the beginning of 1969 Libya was the world's sixth oil producer and fourth oil exporter. Its share of world production was 7% as shown in Table 5.16 above and Diagram 5.3 below. In Africa, Libya produced more than 50% of African crudes; 59% in 1968, and 64% in 1969 [Ministry of Planning 1971].

Even though huge amounts of Libyan gas had been wasted, the acceleration of crude production by oil companies proved to be of major significance. Libya simply could not absorb the attributed oil revenues efficiently. This is evident from the rate of return on capital in the indigenous sectors. Instead it accumulated foreign exchange reserves and did not comply with the Law No. 5 of 1963, which states that at least 70% of oil revenues must be spent on development programs. I will show in Chapter 7

Diagram 5.3


LIBYA
MIDDLE EAST
OTHERS
WORLD OIL PRODUCTION %
1966
1967
1968
1969
1970
YEAR
173A

how Libya made use of such huge accumulated foreign reserves to strengthen its position at the time of negotiations with foreign oil companies. In the next chapter I will analyse the role of oil revenues on the Libyan economy.

Unintentionally, foreign exchange reserves under the monarchy strengthened the position of the revolutionary Government after 1969, as will be discussed in the next two chapters. It should be clear that the Libyan government, at the time of concession granting, showed no sign of possible conflict with the oil companies. The profit and competition motives of oil companies were the main reasons for the rapid development of the Libyan oil industry. As a result the companies gained substantial profits during the 1960s, but the 1970s showed that these companies had to take into account the preferences of the Libyan Government as well as their own interests. The latter point will be discussed in Chapter 7. First I discuss and analyse the post-oil Libyan economy.

CHAPTER 6: THE POST-OIL LIBYAN ECONOMY

The aim of this Chapter is to analyse the post-oil Libyan economy and to assess how far this economy has been affected by the newly developed oil sector. The development of a new sector (any sector) requires the use of the factors of production, land, labour and capital. If these factors are employed in other sectors, and in an economy where the importation of capital and labour is not desired or could not be financed, the boom in the newly developed sector attracts some of the existing factors of production which are inputs to other sectors of the economy. But the reduction in the workforce, for instance, of manufacturing or agriculture or even services would reduce the output capacity of these sectors. In countries where manufacturing industry was most affected by the booming energy sector, as in the case in Holland or Britain, the term used to describe this effect is "*De-industrialisation*" or the "*Dutch Disease*" [Corden 1984]. In a country where the main economic activity is agriculture, Nigeria for example, the problem may take the form of "*De-agriculturalisation*".

In Libya at the time of oil discoveries, as I argued in Chapter 5, neither capital nor skilled labour were locally available, therefore neither manufacturing nor agriculture were so developed as to be affected by development of the oil industry in the sense of movement of resources out of these sectors. What is described as a problem in Holland, Britain or Nigeria may not be seen a problem as such in Libya. The Libyan case is quite different from the usual models mentioned above. Here I attempt to analyse this case and to consider the impact of the booming sector arguments. The main points I intend to discuss in this Chapter are as follows:

(1) The main features of the Libyan economy.

(2) The inflow of capital and labour.

(3) The spending effect of oil revenues.

(4) Socio-economic developments.

(5) Other aggregate economies (i.e. wages and prices).

6.1. The main features of the post-oil Libyan economy:

I argued in Chapter 5 that Libya was receiving foreign assistance on a bilateral basis to provide needed capital for current government expenditures, as well as for some development projects. Thus much of the growth generated can be attributed to the impact of foreign technical and financial assistance. But by 1957 the impact of a new resource, crude oil, had become foreseeable [The International Bank for Reconstruction and Development 1960 p.177]. Foreign private investments in exploration, drilling and construction of oil facilities provided the economy with other financial resources besides the bilateral and multilateral government aid.

The Libyan economy has dramatically changed; oil production and oil revenues increased at a rate never before experienced by an oil producer. GDP and per capita income increased substantially as oil revenues increased. The main features of the post-oil Libyan economy can be summarized as follows:

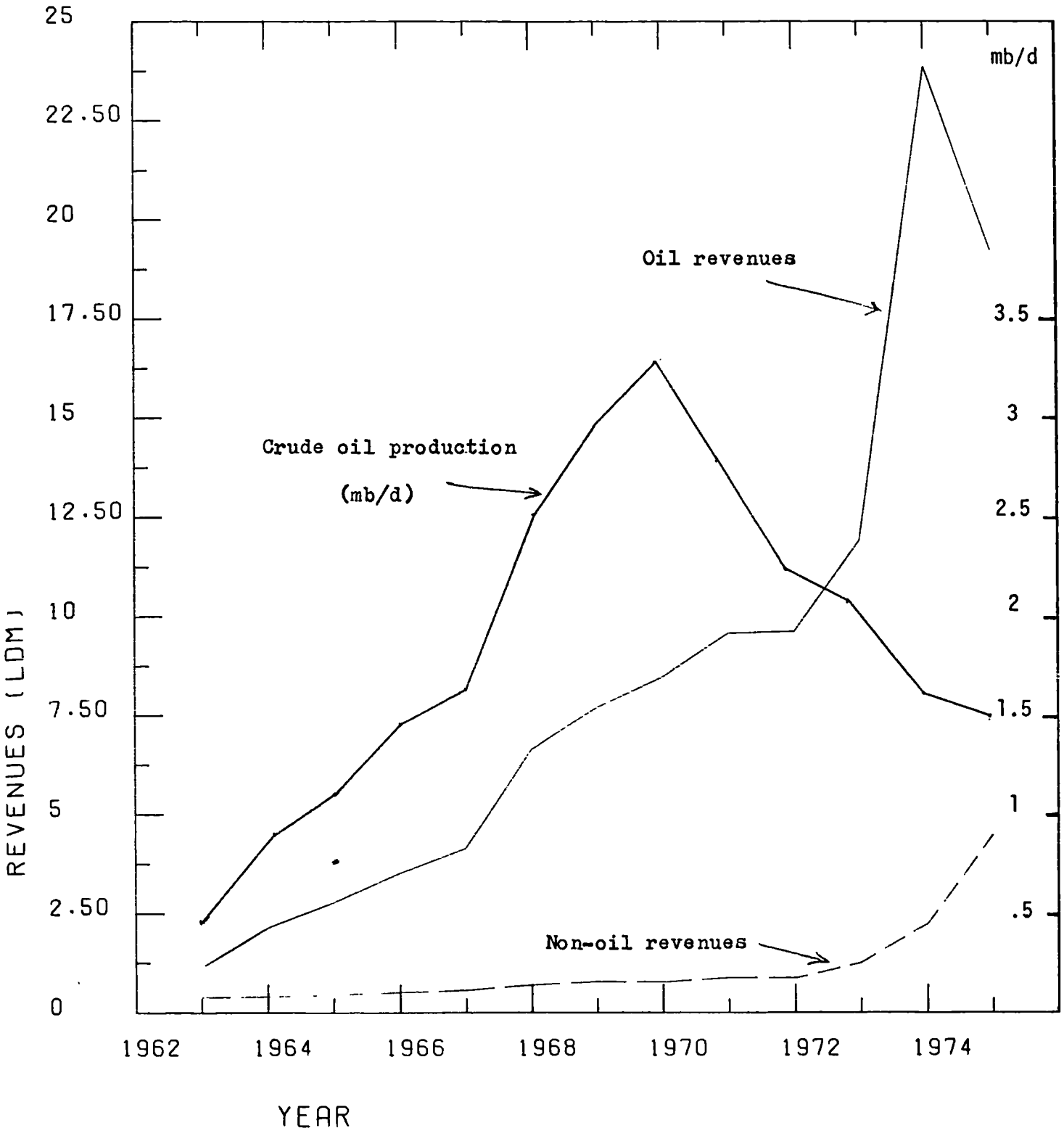
(1) Oil production and revenues:

Soon after the first few shipments of crude oil abroad, in the early 1960s, government revenues increased rapidly. Figure 6.1 below shows the development of oil production and oil and non-oil government revenues between 1963 and 1975. The important features are:

(A) Non-oil revenues constitutes a small portion of the country's total revenues. This clearly shows the significance of oil revenues in their contribution to the government's budget and therefore the impact that oil revenues actually have on the Libyan economy.

FIGURE 6.1

Crude oil production, oil and non-oil revenues 1963-75



XAXIS:SCALE AS PRINTED.

YAXIS:SCALE = Y * (10 **-2)

(B) The very steep climb of oil production and exports in the 1960s, which can be compared favourably with the Arab World, Middle East, and Africa. Oil production increased from less than half a million b/d in 1963 to about 1.7 mb/d in 1967 and reached a peak of over 3 mb/d in 1970.

(C) The third feature of Figure 6.1 is the decline in crude oil production after 1970. This reflects a combination of factors. In the early 1970s the Libyan Government became increasingly concerned with oil conservation, partly because it began to realise that the life span of reserves at the current rates of production might be too short relative to the time horizon of desired economic development, and partly because Libya became suspicious of technical malpractices on the part of oil companies eager to produce as much as they could immediately, irrespective of the long-term damage to future recoverable reserves. In implementing a conservation policy the Libyan Government exploited very intelligently the fragmented character of the community of oil producing companies in Libya, as I argued in the previous two chapters. This point will be analysed further, using game theory concepts, in Chapter 7.

(D) There was a continuous increase in oil revenues despite the decline in crude oil production. Oil revenues increased from £LM117 (million Libyan pounds) in 1963 to more than £LM772 in 1969. [In September 1971 the Libyan currency was changed from the Pound to the Dinar, and one-thousandth of the Dinar was the dirham. At the same time the new currency was revalued in terms of the US dollar from a par rate of $2.80 to LD1 = $2.90]. After the 1973 oil crisis Libya's oil revenues increased to LDB2.4 (billion Libyan dinars) and about LDB6.5 by 1980, just after the Iranian crisis.

The impact of oil, on economic growth has been impressive. From 1960 to 1967 the compounded rate of growth of Libyan national income averaged

21.5%, while for the same period it was 4.07% and 3.75% for Morocco and Tunisia, respectively. Per capita income in Libya was $1,215 in 1968, while for the same year it was $293 in Algeria, $185 in Morocco, and $236 in Tunisia [Abderrahman 1973 p.135].

(2) Gross Domestic Product growth:

The importance of oil in the Libyan economy can be seen clearly from an examination of gross domestic product of the country. GDP as shown in Figure 6.2 increased from LD155.5 million in 1962 to LD7753 million in 1979 [Ministry of Planning 1982 p.25]. Non-oil activities accounted for LD117.5 million in 1962 (75.6% of GDP), and LD3195.2 million in 1979 (41.2% of GDP). However, GDP data at factor cost confirms a number of generalisations about an oil economy.

(A) Little growth occured in agriculture. The contribution of this sector to GDP fluctuated between LDM14.9 (9.6% of GDP) and LDM149.9 (1.9% of GDP) during the 1962-1979 period. (See Table 6.1). These variations are characteristic of an agriculture depending heavily on irregular rainfall.

(B) Manufacturing tends to grow faster than agriculture, although from a small base. The manufacturing contribution to GDP appeared to have a large increase from LD9.0 million in 1962 (5.8% of GDP) to LD185.8 million in 1979 (2.4% of GDP).

(C) The oil boom is always associated with a construction boom, because of increases in investment and because infrastructure and housing generally occupy a significant place in the investment pattern. The contribution of this sector to GDP fluctuated between LDM10.3 (6.6% of GDP) and LDM834.7 (10.8% of GDP) during 1962-1979.

(D) Considerable growth took place in the services sector. Public administration and defence increased their contribution to GDP from LDM15.5

FIGURE 6.2

GDP, oil sector and other sectors (at current prices)

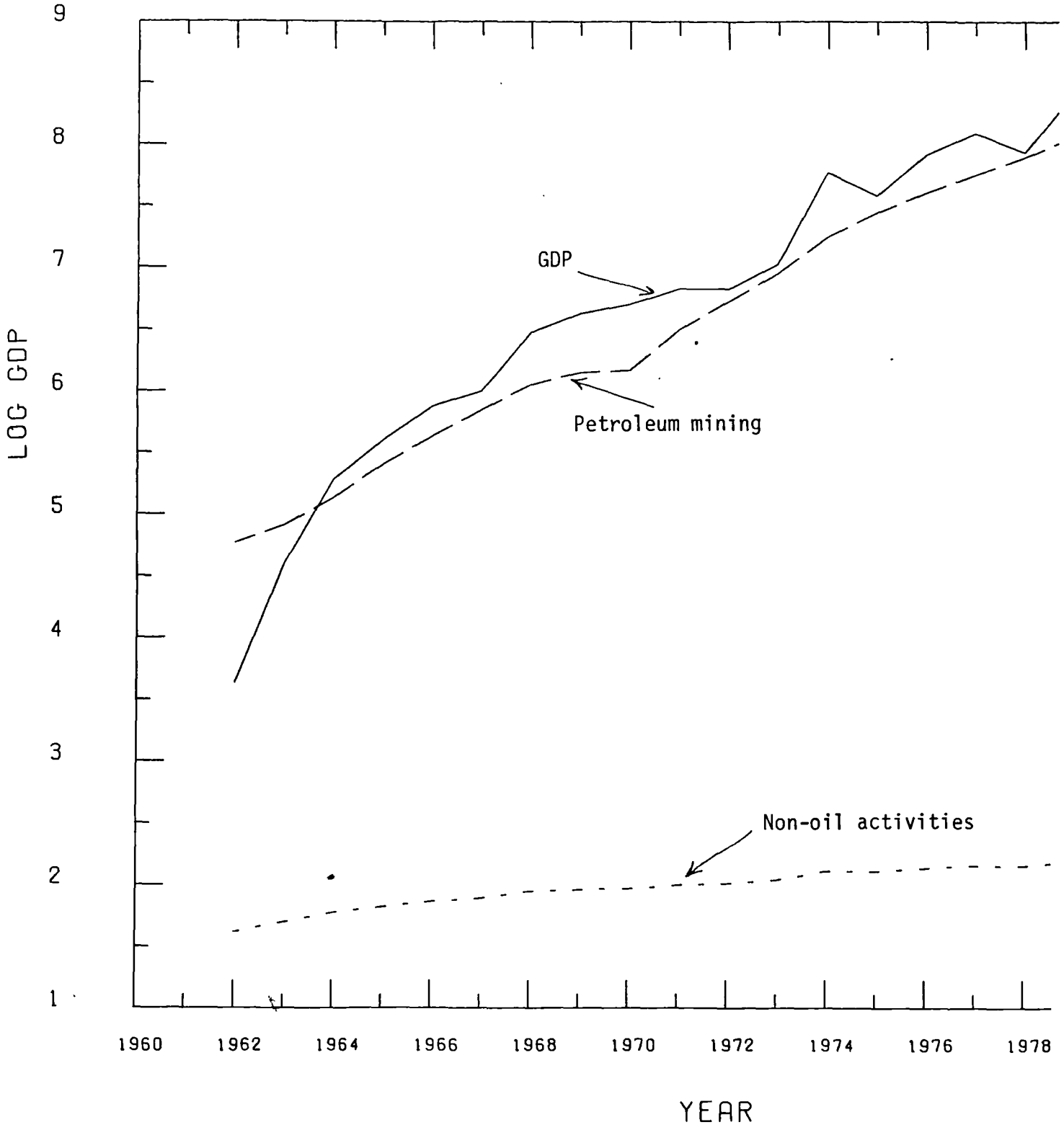


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Table 6.1

Gross Domestic Product of Libya by Sectors(current prices LDM)

Sector	1962	%	1970	%	1979	%
1.Agriculture,Forestry&Fishing	14.9	9.6	33.1	2.6	149.9	1.9
2.Petroleum mining	38.0	24.4	812.6	63.1	4558	59
3.Other mining& Quarrying	0.6	0.4	1.7	0.1	41.5	0.5
4.Manufacturing	9.0	5.8	22.5	1.7	185.8	2.4
5.Construction	10.3	6.6	87.8	6.8	834.7	10.8
6.Electricity and Gas	0.9	0.6	6.2	0.5	40.0	0.5
7.Transportation & Communic.	8.6	5.5	43.2	3.4	301.2	3.9
8.Wholesale & retail trade	14.2	9.1	47.0	3.7	393.2	5.1
9.Banking & insurance	1.7	1.1	8.3	0.6	194.6	2.5
10.Public admini.& defence	15.5	10.0	98.1	7.6	512.5	6.6
11.Educational services	5.0	3.2	39.7	3.1	206.6	2.7
12.Health services	2.1	1.4	15.8	1.2	104.2	1.3
13.Ownership of dwellings	29.4	18.9	59.6	4.6	188.8	2.4
14.Other services	5.3	3.4	12.7	1.0	42.2	0.6
15.GDP at factor cost	155.5	100	1288	100	7753	100

Source: Ministry of Planning, *National Accounts*,(1962-71), 36, 38, and (1971-78), p.192.

(10% of GDP) in 1962 to LDM512.5 (6.6% of GDP) in 1979. Education from LDM5.0 (3.2% of GDP) to LDM201.6 (2.7% of GDP), and health services from LDM2.1 (1.4% of GDP) to LDM104.2 (1.3% of GDP). All these sectors expanded much faster than non-oil GDP (e.g.,1971=238 with 1962=100) [Knapp 1977].

Expenditure of the gross domestic product, as shown in Table 6.2, indicates the change in the share of consumption and investment in relation to GDP. While private consumption increased from 28.8% in 1971 to about 32% in 1975 and then slightly reduced to 28% by 1978, the public consumption share increased at a faster rate, from 19.57% in 1971 to 27.6% in 1975 and 26.89% in 1978. But the highest percentage increase in individual contributions to GDP was confined to imports of goods and services. The increase in the imports share of GDP reflects the growth in total investment, which increased from 18% in 1971 to 26.5% in 1974 and 30.55% in 1975. The imports, as will be seen later, are mostly capital goods which are essential ingredients to domestic investment.

Table 6.2

Expenditure on the Gross Domestic Product at Market Prices (1971-78)

(*Percentage ratio of individual items to GDP.*)

Item	1971	1975	1978
Exports of goods &Services	59.94	54.32	56.16
Imports of goods &Services	26.80	44.07	35.61
Resource gap [1]	33.14	10.25	20.55
Private consumption	28.81	31.57	28.03
Public consumption	19.57	27.63	26.89
Total consumption [2]	48.38	59.20	54.92
Total investment [3]	18.48	30.55	24.53
Gross Domestic Product[1+2+3]	100	100	100

Source: Arab Monetary Fund [1983], p.140.

Per capita income increased every year except those when oil revenues slowed down reflecting the fact that GDP and per capita income still depend on the oil contribution despite the great effort to develop other economic activities. Table 6.3 shows the increase in per capita income and the population growth. Per capita income increased from LD107 in 1962 to LD3155 or about US $10658 in 1980.

Table 6.3

Per capita income in Libya (Libyan Dinar), and population(M)

1962-1980

Year	Per capita	Population	Year	Per capita	population
1962	107	1.45	1972	796	2.20
1963	156	1.50	1973	929	2.35
1964	234	1.56	1974	1510	2.51
1965	304	1.62	1975	1369	2.68
1966	379	1.68	1976	1679	2.84
1967	430	1.74	1977	1910	2.94
1968	595	1.80	1978	1818	3.01
1969	654	1.87	1979	2479	3.13
1970	642	2.01	1980	3155	3.25

Source: *Socio-economic evolution in Libya*, Ministry of Planning, [1980], p.11.

However, despite the growth in GDP and per capita income, the dual character of the Libyan economy has had its impact on the economic as well as social and political aspects of the country. From the economic point of view, two incompletely integrated sectors exist side by side. This was particularly true during the first decade of the oil era, but its significance was greatly reduced in the 1970s as oil revenues became widely distributed, as will be discussed later. The existence of a dual economy

has limited the size of the Libyan domestic market, as the number of people engaged in the modern sector is quite low relative to the total population.

(3) Migrant workers:

Libya has immense wealth and its economic development has been swift. The small population and workforce have required the importation of quite large numbers of migrant workers. Migrants have flooded into Libya, particularly from its neighbours, Egypt and Tunisia. Table 6.4 shows the rapid growth in their numbers through the 1970s up to 1976. There were a mere 17,300 migrants in Libya in 1964, while in 1975 they represented about 33% of the entire workforce. According to the estimates of Birks and Sinclair [1984 p.267], the official figures are rather low and probably misleading. One reason for the discrepancy between the official and estimated figures (see Table 6.4) could be the extent of illegal and undocumented immigration. Libyan officials are either unwilling or unable to take account of its full extent in official planning documents. The discrepancy is of major significance for the analysis of investment efficiency and productivity in such sectors as agriculture and construction. It also raises the very important question of the productivity of nationals.

Table 6.4

Growth of Migrant Workers in Libya

Year	Official data	Birks and Sinclair estimates
1970	50,000	
1971	64,000	
1972	81,000	
1973	118,350	
1974	169,770	
1975	223,000	323,000
1976	262,600	n.a
1977	n.a	n.a
1978	252,300	n.a
1979	n.a	n.a
1980	280,000	518,500

Source: Birks and Sinclair [1984], p.267.

The migrant workforce in Libya are of all skill levels and are widely dispersed throughout the economy. The construction sector is the principal provider of non-national employment, followed by educational services, agriculture and manufacturing. There is good reason to believe that in future years the employment of non-Libyans in the manufacturing sector will grow, while their employment in construction declines. At least it will decline if Libyan demand for housing and infrastructural and development spending ever ends.

Table 6.5 shows that a small but significant number of migrants work in the agriculture sector, and this illustrates another remarkable facet of Libyan development, namely the agricultural sector's dependence on expatriate labour. Almost certainly these immigrants work in those parts of the agricultural sector which are *modern* , in the sense of being

capital-intensive, using modern technology, and where labour productivity is relatively high. There may, however, be a certain number of immigrants on traditional farms, where they will earn very low wages and exhibit low productivity.

Table 6.5

Distribution of Migrant Workers by Economic Sector in Libya

1975 and 1980*

Economic Sector	1975		1980	
	No.	%	No.	%
1.Agriculture	17.6	7.9	23.1	8.2
2.Petroleum & Gas	2.7	1.2	2.9	1.0
3.Mining & Quarrying	2.8	1.3	3.7	1.3
4.Manufacturing	13.8	6.2	23.2	8.3
5.Electricity,Gas & Water	3.6	1.6	5.4	1.9
6.Construction	118.0	53.0	129.5	46.2
7.Trade,Restau.& Hotels	7.7	3.5	4.5	1.6
8.Transport & Communic.	6.2	2.8	11.7	4.2
9.Finance & Insurance	1.6	0.7	2.5	0.9
10.Public Administration	5.2	2.3	6.0	2.1
11.Education	14.1	6.0	30.6	10.9
12.Health	9.8	4.3	18.2	6.6
13.Other	19.6	8.8	18.7	6.8
Total	222.7	100	280.0	100

(*) Official Estimates.

Source: Birks and Sinclair [1980].

Libyan manpower shortages are aggravated partly by political and partly by social reasons. On the political side, Libyan relations with Egypt deteriorated in the mid 1970s to the point where in 1977 Libya and Egypt

broke off diplomatic relations. A result of this dispute was that Libya dropped Tobruk as an industrial centre and is said to have expelled 100,000 Egyptian workers. Many Egyptian workers left, either voluntarily or involuntarily, have but returned to Libya a short time later.

The social side is actually related to the problem of manpower in Libya. Given a choice, migrant workers from within the Middle East prefer to work in Western Europe; the Gulf and Arabian Peninsula states are a second choice. The conditions under which migrant workers are required to live in Libya, and to a great extent in the Gulf, are harsh. Social mores and customs are often applied quite rigorously, and this tends to reduce the number of migrant workers [International Labour Organization 1980 p.81].

Thus, despite the socio-economic problems which tended to reduce the number of migrant workers coming to Libya, productive sectors in the economy still, to a great extent, depend upon the migrant workers, especially in oil because of its nature as a highly technical industry. The inflow of both capital (through oil companies) and labour from various countries has accelerated the development of the oil industry as well as non-oil activities, as will be discussed next.

6.2 The inflow of capital and labour:

According to resource movement concepts, the boom in the energy sector raises the marginal products of the mobile factors employed within the sector, and so draws resources out of other sectors. This gives rise to various adjustments in the rest of the economy, one mechanism of adjustment being the real exchange rate [Corden and Neary 1982 p.827].

Suppose that D_oD_o in Figure 6.3 below, is the demand for labour in the oil booming sector, where the wage rate (in terms of manufacturing) is measured on the vertical axis and labour supply measured on the horizontal axis. The energy sector's labour demand schedule shifts upwards, as shown

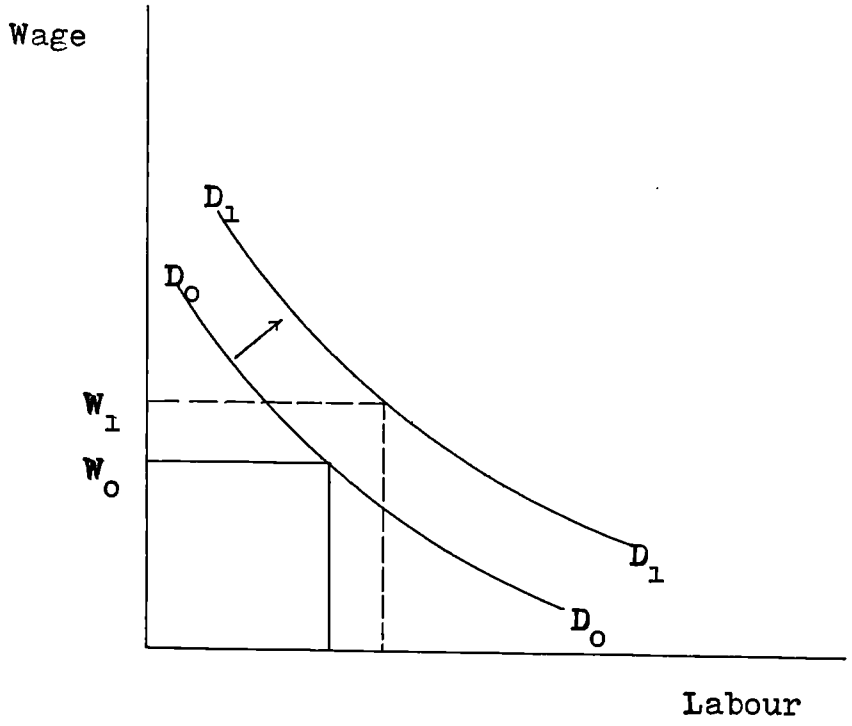


Figure 6.3

in the Figure, by an amount proportional to the extent of technological progress. The latter acts exactly the same way as a price increase, raising profitability and the demand for labour in the energy sector at a given wage rate.

This effect, which raises the wage rate in the oil sector to (W_1), at a constant real exchange rate, thus causes labour to move out of both the manufacturing and services sectors. Such reduction in the manufacturing and services labour force may result in a decline in production by these sectors. Thus we may say that the resource movement effect gives rise to direct de-industrialisation.

Such an effect, which may be applicable in such developed countries as Holland or the UK, is of no significance in the case of Libya or in other oil-rich developing countries. Generally, the distinction between the two types of economies in regard to the resource movement effect can be stated as follows:

(a) The developed economies have a mature infrastructure, involving manufacturing as well as services, while Libya for instance has just begun the process of building up such socio-economic infrastructure since 1963.

(b) Oil revenues in an oil-rich developed country constitute a small proportion of national income, thus the overall effect of income from oil on the economy is not felt as much as in a developing country which is heavily dependent on oil revenues.

(c) In Western countries the free-market system and the existence of mature money markets allow for flexible movement of capital as well as for exchange rate fluctuations. This is not the case in a number of oil developing countries with underdeveloped markets, such as Libya.

However, taking the above remarks into account, the following facts concerning the resource movement effect of oil revenues on the Libyan

economy, show clearly that it takes a completely different form from the de-industrialization or de-agriculturalization effect.

(1) The oil industry is a capital intensive industry or capital extensive industry according to Machlup [1983 p.58]. In Libya the oil industry was, until the Government take over in the 1970s, run completely by the multinational oil companies. There had been no Libyan capital involved in the development of the Libyan oil industry when it first started. In other words, there had been no capital movement from any sector of the economy to the oil industry.

(2) The oil sector employs a relatively small proportion of the labour force. According to the Industrial Census of 1964, firms holding concessions employed 5510 workers. Concessionaires provided jobs for less than 1.5% of the whole labour force [Mabro 1970 p.321]. Table 6.6 below shows the growth in oil concession workers. At the beginning and the end of the period (1964-1969) the number of such workers was at the same level (1.5%) in relation to Libyan total employment. This indicates that there was no employment shift to the oil industry on the account of any of the other sectors of the economy.

Table 6.6

Oil Concessions Employment in Libya (000 Workers): 1964-69

Year	No.of oil concession workers	% of total	Total employment
1964	5.5	1.5	365.3
1965	5.9	1.6	372.2
1966	5.7	1.5	380.2
1967	5.4	1.4	389.3
1968	5.7	1.4	400.5
1969	6.2	1.5	414.6

Source: Ministry of planning, *Economic and Social Indicators*, [1982], p.8.

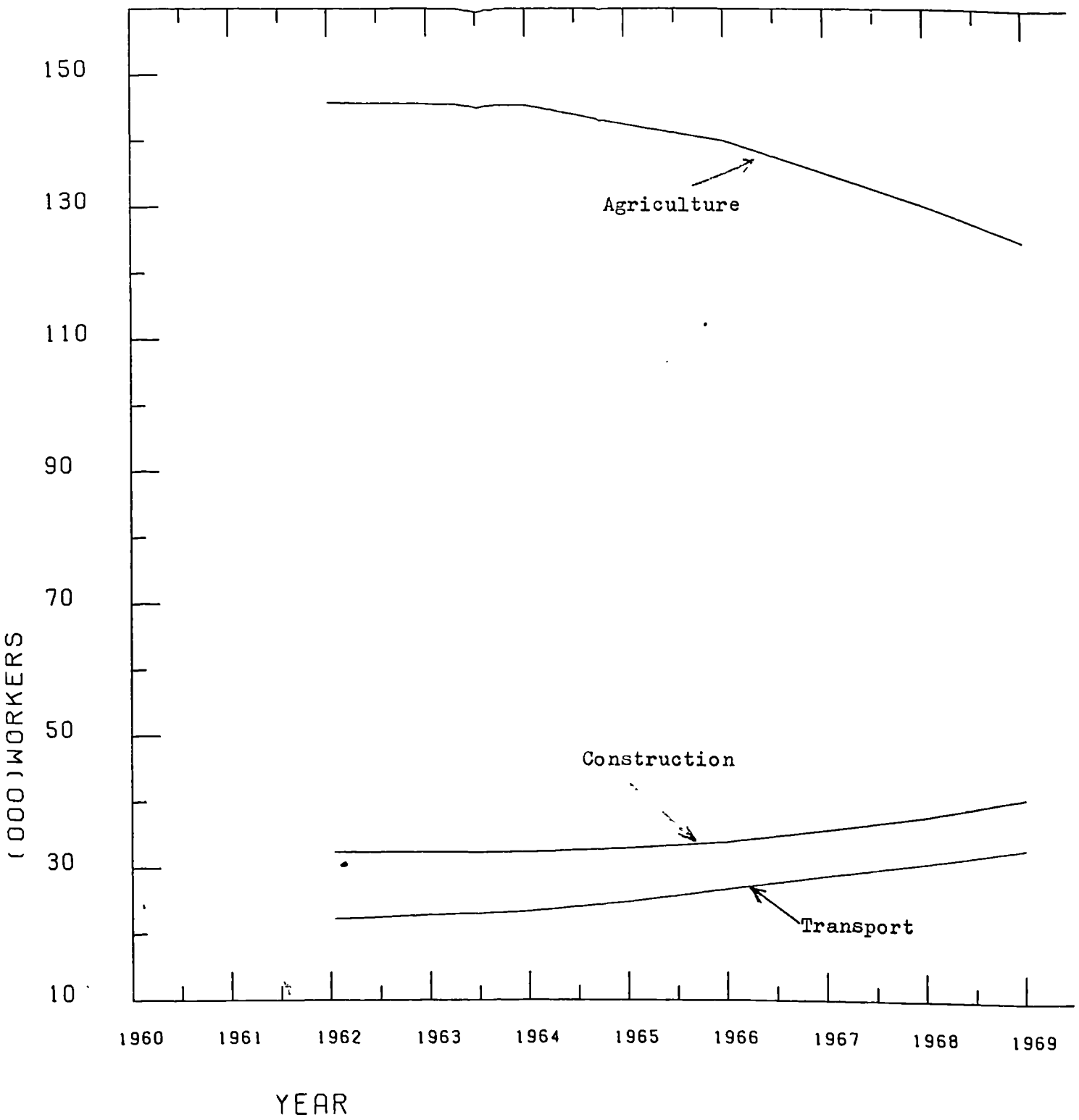
(3) Manufacturing industry was small in size, as was the number of workers employed. It employed 6.6% of the total labour force in 1964, and about 4.7% in 1969. Here also there was no obvious employment shift from this sector to the booming oil industry.

(4) Even agriculture, by far the largest sector in the Libyan economy as far as labour is concerned, has not been affected by the oil sector in terms of employment movement. Agriculture accounted for 41% of the total labour force in 1962 and 40% in 1964. The lowest Figure for agriculture employment was in 1969 (125,000 workers) or about 30% of total labour force. Figure 6.4 below suggests that the reduction in the number of agricultural workers, which is a sign of development, was as a result of the increase in the number of workers in construction, transport and other sectors through the spending effect of oil revenues, and not due to the resource movement effect to the oil sector.

It should be clear that despite the reduction in the number of workers in both agriculture and manufacturing during the first decade of the Libyan oil industry (1960s), neither sectors have actually experienced a decline

FIGURE 6.4

Employment in Libya 1962-1969 (selected sectors)



in production levels. This is so because of the existence of some unemployment in agriculture which rises during the off seasons, and the steady increase in the number of foreign workers (Table 6.7). This once more assures us that the booming oil industry has had no appreciable effect on of agriculture and manufacturing.

Table 6.7

Growth of production and employment

in agriculture and industry in Libya: 1963-1969

Year	Agri.growth(%)		Manuf.growth(%)		Foreign workers
	prod.	employ.	prod.	employ.	growth(%)
1963	1.3	-0.1	10.0	0.0	3.1
1964	10.6	-0.1	16.2	0.0	3.6
1965	50.9	-1.9	9.6	-0.4	11.7
1966	8.3	-1.8	14.3	-2.5	14.7
1967	13.2	-3.4	13.9	-4.8	16.9
1968	8.1	-3.5	22.0	-5.5	21.9
1969	12.0	-4.2	4.0	-6.7	26.3

Source: Ministry of Planning [1982], pp.9 and 29.

Sociological surveys show that the internal migrants of the mid-1960s did not leave the farms with the expectation of employment in the petroleum sector, but rather they were attracted to the urban centres because of the relatively higher wages paid in construction, industry, and government [Mukergi and Kataifi 1970].

The land tenure system and extended family structure were probably factors that caused farmers to migrate to urban centres. The widespread tribal land tenure system tends to inhibit growth in agricultural incomes by discouraging capital improvement on the land. The extended family structure as it is practiced in rural Libya also contributes to the

backward state of agriculture. In 1965 an FAO study concluded that those factors would continue to operate until the Libyan farmer is given security of tenure and investment [FAO 1969 p.14]. The movement of the national labour force was, in fact, from the goods sector (including the oil sector of which employment actually declined) to the services sector during the first decade of the boom as shown in Figure 6.5. This is, as I will show later, because of high wages in the service sector relative to the goods sector.

However, the resource movement effect of oil revenues on the Libyan economy has been on the form of inflow of both foreign capital and labour. This shift is of major significance because it not only prevented a de-industrialisation or a de-agriculturalisation effect, but it also provided the other sectors of the economy with skilled and non-skilled labour force. At this point I turn to discuss the spending effect of oil revenues.

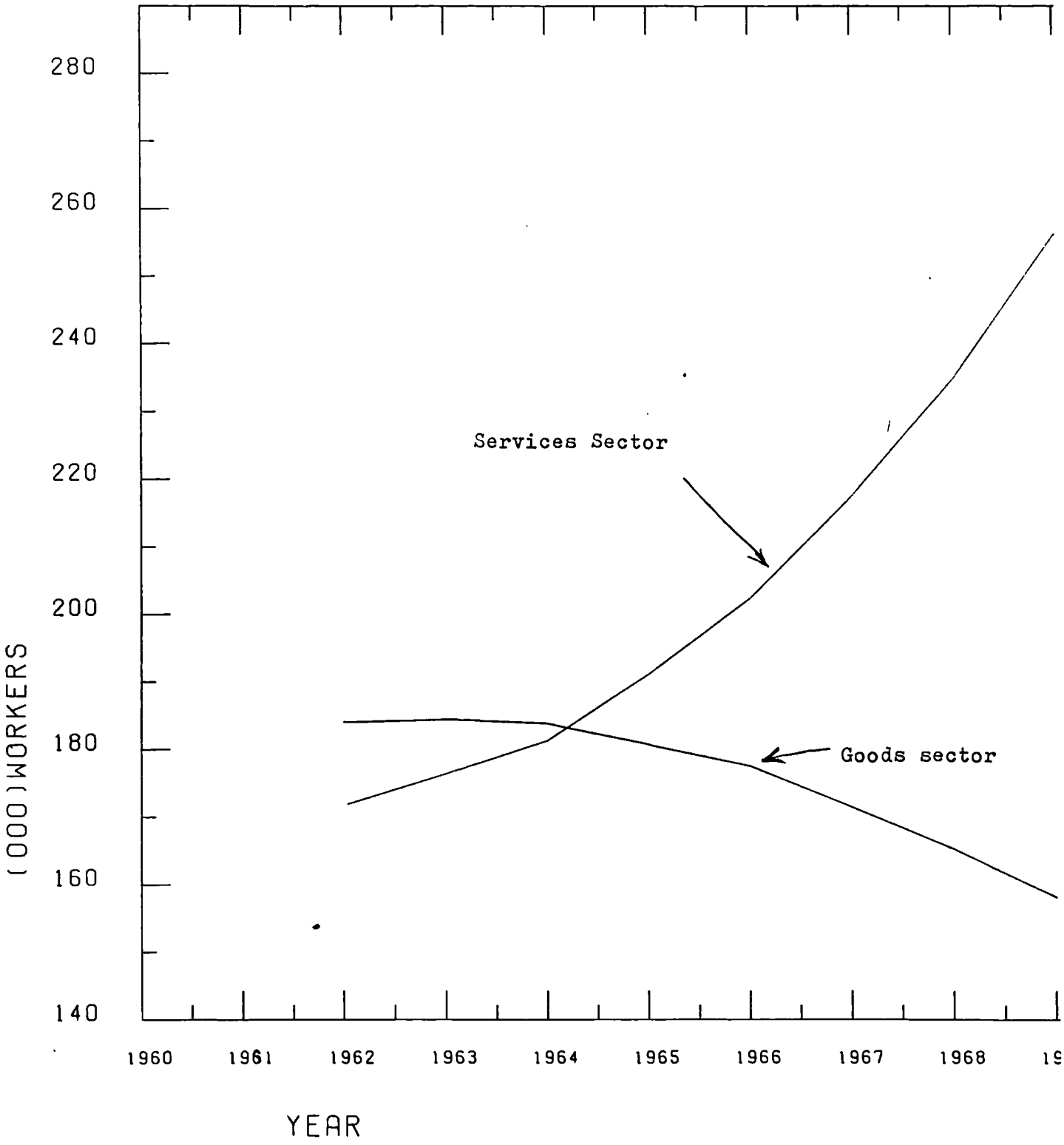
6.3 Spending effect:

According to this concept, the higher real income resulting from an oil-boom leads to extra spending on services, which raises their output (i.e. causes a real appreciation) and thus leads to further adjustments [Corden and Neary 1982 p.830]. The rate of exchange depends on the supply of a currency in the foreign exchange market in relation to the demand for it in that market. The demand for a country's currency is derived from the demand for that country's exports; the supply of its currency depends on its demand for imports, both visible and invisible. When the demand for a currency in the foreign exchange market is large in relation to the supply, it will bring about an appreciation of the currency.

It is assumed here that the energy sector does not use any labour already in use in other sectors of the economy. Hence at the initial real exchange

FIGURE 6.5

Labour force movement in Libya (000 workers) 1962-69



rate the boom has no effect on the economy's labour supply. Provided the demand for services rises with income, demand at the initial real exchange rate moves along an income-consumption curve such as ON in Figure 6.6, which intersects T'S (the new production possibility curve) at point c

Once again, there is excess demand for services at the initial real exchange rate and so a real appreciation must occur. The new equilibrium must lie somewhere between j and c.

If the resource movement effect is stronger than spending effect, the new equilibrium would be somewhere between b and j indicating a decline in the output of services. If this is not the case, because the spending effect is stronger, the post-boom equilibrium would be somewhere between j and c, indicating an increase in the output of services.

More than that, Van Long [1983 p.57] has argued that the mineral export boom may result in.

(1) An expansion of all industries.

(2) An increase in the profitability of the traditional tradeables sector.

Apart from the differences mentioned earlier between the developed economies and the Libyan economy, the notion of the spending effect of oil revenues provides a significant insight in understanding the post-oil Libyan economy. The idea of expansion in all economic activities is very likely in the Libyan case. Even though the exchange rate in Libya is fixed, the increase in prices of imported goods and services relative to export prices brings favourable terms of trade. This means the country can obtain more goods and services from abroad. This is equivalent to an appreciation effect concerning the spending effect of oil revenues in a free market economy. This point will be further discussed later, when I examine inflation in Libya.

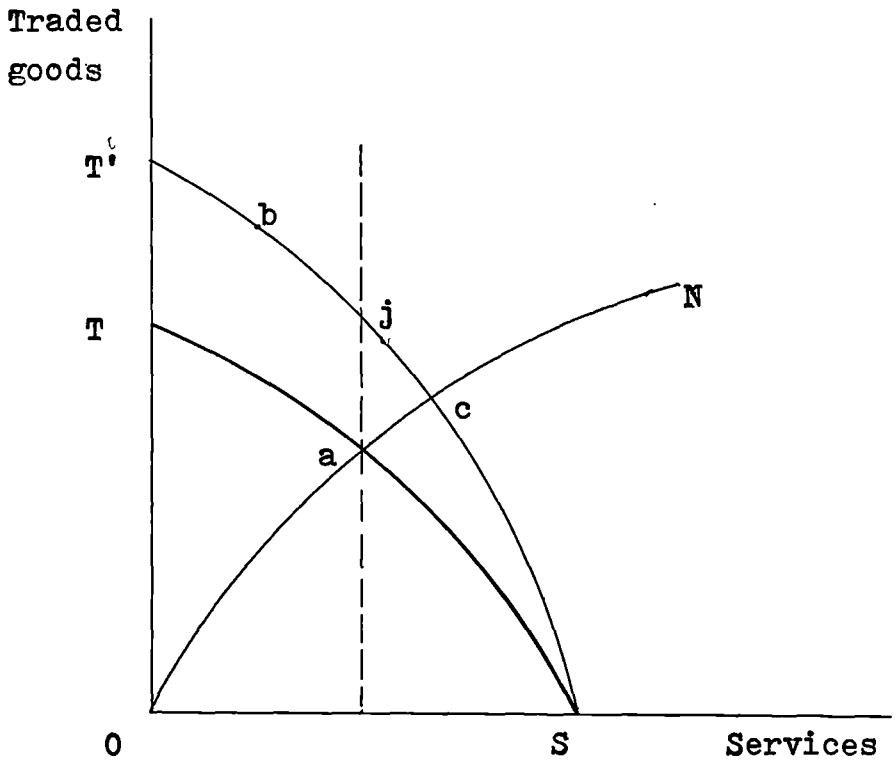


Figure 6.6

The increased oil revenues after 1963 enabled the Libyan public sector to finance a massive development programme. These large amounts of development expenditures were an important factor in creating higher demand for food products, capital, raw materials and labour which the domestic economy was unable to satisfy. The result was growth with inflationary pressure. The government tried to lessen the inflationary trend by opening the country to imports of goods and services, including the importation of labour. To analyse the spending effect of oil revenues on the Libyan economy I proceed by considering the following:

(1) Oil and government income.

(2) Institutional arrangements and planning.

(3) Demand for goods and services.

(4) Sectoral development.

(5) Personal income and wages.

(6) Inflation.

6.3.1 Oil and government income:

I mentioned earlier in this chapter that oil revenues have increased substantially since the export of crude oil began in commercial quantities. They increased from £LM117 in 1963 to more than £LM772 in 1969. After the 1973 oil crisis Libyan oil revenues increased to LDB 2.4 (billion Libyan dinars) and to about LDB 6.5 by 1980.

As I argued in Chapter 5, the development of the oil industry in Libya was from the early stages under the control of the Government. This point is of great significance, since the growth in the oil industry and oil revenues would increase the Government domination over the economy. On the other hand it would mean a decline in the share of the private sector, both in production and investment.

The management of capital formation was also gradually moving out of the

private sector into government-run projects and, whereas the private sector was responsible for over 70% of the capital formation in 1962, by 1967 this had fallen to under 50%. After a recovery in private sector activity up to 1969 it fell away steadily as a proportion of total activity until 1971, when it was only 38%, and the proportion fell steadily thereafter.

The tendency to massive public investment, especially after 1969, is evident. The emphasis early in the 1970s on infrastructure and agriculture is borne out by the pattern of investment, shown in Table 6.8. Social services and infrastructure absorbed large proportions of total investment in 1975. This is not surprising however, since there was an acute absence of infrastructure, which became particularly obvious when domestic expenditure rose in line with oil income. The limited provision of social services in the early 1970s also occasioned substantial investment in government services. In such areas as education and health, Libyan standards are improving dramatically [Allan 1981 pp.232-252].

Table 6.8

Gross Fixed Capital Formation in 1975, 1980*

And Anticipated (1981-1985)* in (LDmillion)

Economic Sector	1975	%	1980	%	1981-85	%
1.Agriculture	149.9	14.2	205	14.1	1,400	12.5
2.Manufacturing	121.5	11.5	218	15.0	2,000	17.9
3.Electricity & Water	135.1	12.8	223	15.4	1,600	14.3
4.Transport & Communi.	157.8	15.0	241	16.6	1,800	16.1
5.Housing	235.5	22.3	158	10.9	1,500	13.4
6.Public Services	91.4	8.7	150	10.3	1,000	8.9
7.Education & Health	99.3	9.4	135	9.3	1,000	8.9
8.Other(Oil,Trade etc)	64.2	6.1	121	8.4	0,900	8.0
Total	1,054.7	100	1,451	100	11.200	100

(*) Constant 1979 prices.

Source: *Second Five Year Plan*, Secretariat of Planning [1982], p.41.

Agriculture received a substantial share of investment expenditure, both in 1975 and 1980 as shown in Table 6.8. In 1980 the share accounted for by industrial investment is anticipated as increasing to the point where it almost absorbs the highest share of investment. This trend towards an increasing emphasis on industry is echoed in the current 1981-1985 Plan, with it absorbing 18% of all investment in the period 1981 to 1985. Taken together however, "electricity and water" and "transport and communication" comprise 30% of total investment. Infrastructure will therefore continue to be a major component of Libyan planning and domestic expenditure.

Thus the Government control over planning and developing the economy has been growing over time. This was mostly due to the increased oil revenues during the 1960s and furthered by the government since 1969. Government expenditure no doubt covered all sectors of the Libyan economy and the

fruits of oil revenues reached every household in one way or another, but the priorities of successive governments' spending on various sectors of the economy differ. Their efforts in institutional building, planning and managing the country's resources will be discussed next.

6.3.2 Institutional arrangements and planning:

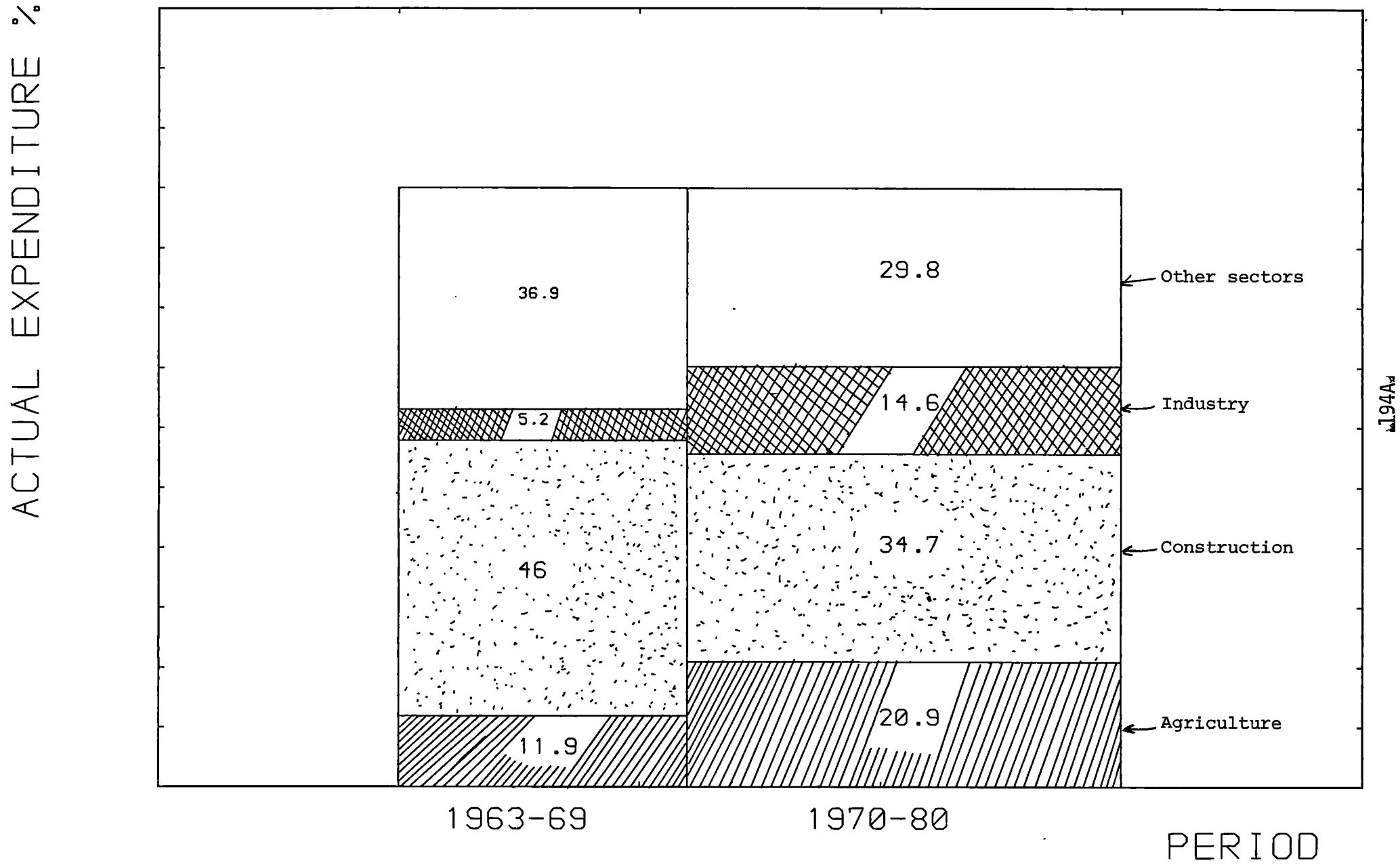
It took the Libyan Government some time after the first shipment of crude oil abroad in 1961 to make institutional and administrative arrangements to cope with the new situation of the expected abundant wealth. New Ministries of Petroleum Affairs and Industry were created in May 1961, and in April 1963 as I mentioned earlier in Chapter 5.

During the same period constitutional changes were made to end the federal arrangements. The unity of the State led to a concentration of constitutional power and to the centralization of planning. A National Planning Council was introduced to examine matters of planning policy, and a Ministry of Planning and Development was set up to administer and execute planning and development. Measures were taken to regulate banking activities under a Banking Law of April 1963, and the Bank of Libya assumed the full powers of a Central Bank. In addition to the establishment of a legal minimum reserve for the Central Bank, it set interest and commission regulations for the Libyan commercial banks.

During the last two decades and since commercial shipments of Libyan oil in the early 1960s, planning for development in Libya had been concerned for an overall development of the economy.

Accordingly, actual development expenditure in Libya is taken as a measurement of absorptive capacity of the economy [El-Jehaimi 1975 p.62]. Particular attention has been given to agriculture, construction and industry. Diagram 6.1 shows that more was spent on construction and agriculture than on any other sector during the first five-year plan

Diagram 6.1


ACTUAL EXPENDITURE %
36.9
29.8
Other sectors
5.2
14.6
Industry
46
34.7
Construction
11.9
20.9
Agriculture
1963-69
1970-80
PERIOD
194A

(1963-1968), while since 1970 priority has been given to agriculture, housing and industry.

Article 11 of Law No.5 of 1963 provided that the funds for government's development programmes were to be supplied by:

(1) Amounts allocated by the government for development, "*provided they should not be less than 70% of the oil revenue*".

(2) Amounts allocated from loans which are provided by the government.

(3) Amounts and monies allocated by the government in accordance with international agreements or agreements made with international organizations [Farley 1971 p.195].

Article 11 of Law No.5 remains in force, but the government has not been able to comply with the Law. In the period between 1963 and 1969, only 20% of oil revenues were spent for development programmes, and only 40% during 1970-80 period. The level of absorptive capacity (actual expenditure) of the Libyan economy in relation to development allocations and oil revenues is shown in Diagram 6.2 below.

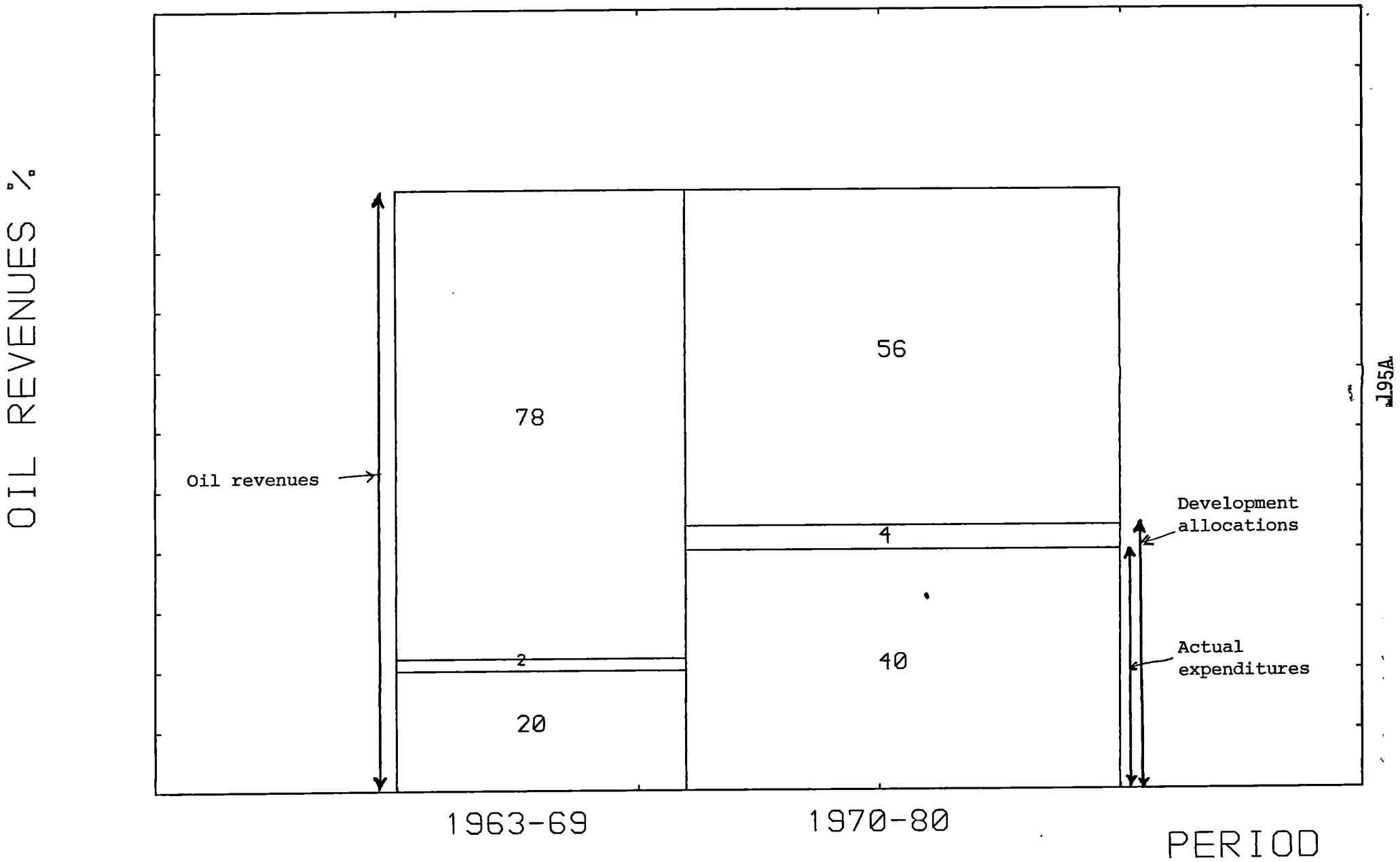
The Libyan Government was unable to comply with the Law for two reasons:

(a) Oil revenues grew more rapidly than was initially anticipated.

(b) The absorptive capacity of the Libyan economy was so limited that investment of 70% of oil revenues would have driven the marginal productivity of capital to zero [El-Maihub 1977 p.35].

Libya adopted a first five-year plan (1963-68) soon after its emergence as an oil-exporting country. As oil revenues grew faster than originally expected, the plan was continually expanded through additional allocations. Initially, planned expenditures were set at £L169 million but the final version budgeted for £L625.3 million. The plan sought to remedy the deficiencies which had affected the economy and to secure the optimum exploitation of the country's resources, as well as to preserve the

Diagram 6.2


OIL REVENUES %
Oil revenues
78
56
4
2
20
40
Development allocations
Actual expenditures
1963-69
1970-80
PERIOD
195A

nation's security, dignity and prosperity. There were seven major objectives for the plan [Ministry of Planning, Development Plan (1963-1968)]:

(1) To ensure the early improvement of the standards of living of the people, particularly those of limited income who did not benefit from the economic prosperity.

(2) To give special consideration to the agriculture sector, being the source of supply of most of the essential consumer goods, besides being the source of income and employment for the majority of the people; to improve the productive efficiency of farms and labour; and to encourage the private sector to make investments in these fields.

(3) To permit the public sector to continue in such services as education, health, communications and housing, together with other sectors as required to consolidate the basic elements for rapid economic growth.

(4) To develop rural areas by establishing production and public service projects, thus ensuring regular employment for people in the countryside, utilising their productive faculties and raising their incomes in such a way as to achieve justice in the distribution of national income and restrict their migration into the cities.

(5) To organise the imports policy to avoid importation of all goods which can be produced in the country on the one hand, and to ensure protection from the danger of inflation and the provision of sufficient supplies of the capital goods needed for development on the other; at the same time striving to set up local production and adopt an appropriate customs policy for its protections and in this way gradually and continuously substitute local production for the mass of such imports.

(6) To take such monetary, financial and commercial measures as may be necessary to ensure increased revenue and to enforce control on

expenditures.

(7) To take steps to meet the lack of information and statistical data which are necessary for planning, by strengthening existing statistical organs and by studies and research work.

Accordingly reconstruction, investment in infrastructure and housing were the main priorities in that 49.6% of the version budget was allocated to communications, public works, and housing as shown in Table 6.9 below. Agriculture was next with 10.1%, followed closely by education at 9.6% .

The actual expenditure was less than the allocations by £L74.3 million. The failure to meet investment targets is not uncommon in an oil economy as planners and governments always tend to under-estimate the real constraints on implementation: manpower, infrastructure, and institutional limitations. Communications and housing (including public works) absorbed 46% of actual expenditure. This may be compared with the 11.9% share absorbed by agriculture, 8.6% by education, 5.2% by industry, and 3% by public health [Knapp 1977 p.216].

The 1963-68 development plan was followed by a second five-year plan (1969-74) which was scrapped by the Revolution on 1 September 1969. The new Government wanted to raise priorities and objectives and establish a new institutional framework. During 1970-72 the Government spent £L791 million on economic and social development. The emphasis in that period rested heavily on housing, 19% (about £L149.1 million) of actual expenditure, agriculture at 17.1% (about £L135 million), and industry at 13.8% (£L109 million) [Bank of Libya, Economic Bulletin Oct/Dec. 1979].

Unlike the first five-year plan (1963-68), which emphasised communication and public works, the three-year plan (1973-75), after the revolution, emphasised agriculture and land reclamation, housing, and industry. LD555 million (more than 25% of actual expenditure) was spent on agriculture,

Table 6.9

First Five Year Plan (1963-68) and Additional Year 1969;

Original allocation, Final Version, & Actual Expenditure (£LM)

Sector	O.Plan	%	V.Plan	%	A.Exp.	%
1.Agriculture & forestry	29.3	17.3	63.0	10.1	65.4	11.9
2.Industry	6.9	4.1	32.6	5.2	28.5	5.2
3.National economy	2.9	1.1	5.5	0.9	4.3	0.8
4.Communications	27.5	16.2	118.6	19.0	91.6	16.6
5.Public works	38.7	26.6	82.2	13.1		
6.Education	22.4	13.1	59.9	9.6	47.6	8.6
7.Health	12.5	7.4	24.3	3.9	16.5	3.0
8.Labour & social affairs	8.7	5.1	29.7	3.0	20.2	3.7
9.News & guidance	2.6	1.5	10.4	1.7	6.6	1.2
10.Public administration	6.4	3.8	0.8	0.1	46.3	8.4
11.Planning & develop.	11.4	6.7	9.7	1.5	5.0	0.9
12.Housing	-	-	109.3	17.5	192.2	29.4
13.Interior	-	-	52.3	8.4		
14.Electricity	-	-	25.3	5.0	56.8	10.3
15.Other	-	-	1.7	0.3		
Total	169.1	100	625.3	100	551.0	100

Notes: (1) Fiscal Years, April-March.

(2) Actual expenditures for Interior are included under Public administration, and for Public works are included under Housing.

LD336 million (15.3 of actual expenditure) on housing, and LD269 million (about 12.3%) on industry.

Again, in the Second five-year plan (1976-80) and the Third five-year plan (1981-85), the emphasis was on agriculture and land reclamation, but at a lower rate, with 19% of total allocations in the Second five-year plan, and 16.7% in the third five-year plan. Industry and Housing are the second important sectors according to the plans as shown in Table 6.10 below.

Growth was still impressive by world standards, with the non-oil sector averaging 10.9% a year. To give more achievable figures, the overall target in the (1981-85) plan, was set at 10.3% per annum [Lloyds Bank, 1983 p.5].

As I argued early in this chapter and in Chapter 5, oil exports increased rapidly during the 1960s, with it oil revenues increased substantially. The favourable terms of trade in the 1960s enabled Libya to obtain more goods and services from abroad. Thus, rapid development of the oil industry continuously improved the balance of payments. The demand for domestic and imported goods, services and labour and the impact of oil revenues on the balance of payments as a whole will be discussed below.

6.3.3 Demand for goods and services:

The effect of spending oil revenues on the Libyan economy can be expressed as a shift to the right in the demand curve for goods and services. This shift was a result of increased oil revenues which, as I argued above, increased both GDP and per capita income substantially. Spending these revenues through administrative and ambitious development plans increased the purchasing power of the community, shifting the demand curve to the right

This shift in the demand for goods and services was furthered by the

Table 6.10

Transformation Plans (1976-80), and (1981-85) in LDM

Sector	(1976-80)Plan		(1981-85)Plan
	Allocations	Expen.	Allocations
1.Agriculture	1818.8	1695.3	3100
2.Industry & Minerals	1463.5	1250.5	3930*
3.Oil & Gas	411.2	367.4	200
4.Electricity	858.4	1000.9	2000
5.Education	588.6	464.8	1000
6.Information & Culture	124.5	120.0	150
7.Manpower	57.0	43.2	150
8.Public Health	310.1	258.8	560
9.Social affairs,S.security	23.0	15.8	130
10.Youth & Sports	75.6	51.7	100
11.Housing	1007.0	864.5**	1700
12.Municipalities	748.1	890.9	1300
13.Communi.& Marine trans.	1051.0	1086.4	2100
14.Economy	86.8	104.2	500
15.Planning	26.0	17.2	80
16.Project reserves	164.5		1500
Total	8813.1	8231.6	18500

(*)This figure includes LD2730 million allocated for heavy industries

(**)Including Justice.

Source: Ministry of Planning, *Socio-economic servey for (1976-80) Plan*, p.63, and Central Bank of Libya, [1980], p.74.

increase in population and a large increase in foreign workers. The latter group brought with them a new style of life and a new pattern of consumption requirements. Such developments in demand can be observed through the decline of local non-oil exports and the increase in imported goods and services.

It is normally expected that in an economy highly dependent on a single commodity for its living, the exports trend would be very much in tune with the gross domestic product. This is exactly the case in Libya since oil began to be exported in commercial quantities in the early 1960s. Table 6.11 below shows that the non-oil trade balance has been increasingly in deficit. The 1958 deficit was £LM11, increased to £LM59 in 1963 and more than tripled by 1970, to £LM205.

Table 6.11

The Effects of Oil Exports on Trade Balance in Libya (£LM)

1958-1970

Item	1958	1962	1963	1967	1970
(1) Non-oil exports	+5	+3	+2	+2	+3
(2) Imports	-16	-49	-61	-140	-205
(3) Non-oil trade balance	-11	-46	-59	-138	-202
(4) Oil exports	+10*	+35	+62	+231	+569
(5) Oil and Non-oil trade balance	-1	-11	+3	+93	+369

(+-) Signs show foreign exchange earnings and outgoings respectively, and not increases and decreases.

(*) This value represents payments for concessions.

Source: Central Bank of Libya, *Balance of Payment*, various issues.

Exports, mostly of agricultural produce, diminshed somewhat, but did not

by any means cease with the arrival of the oil era. This sector, as I argued above, has been very much affected by rainfall fluctuations and to some extent by the movement of the labour force from agriculture in the rural areas to the booming services sector in the urban areas.

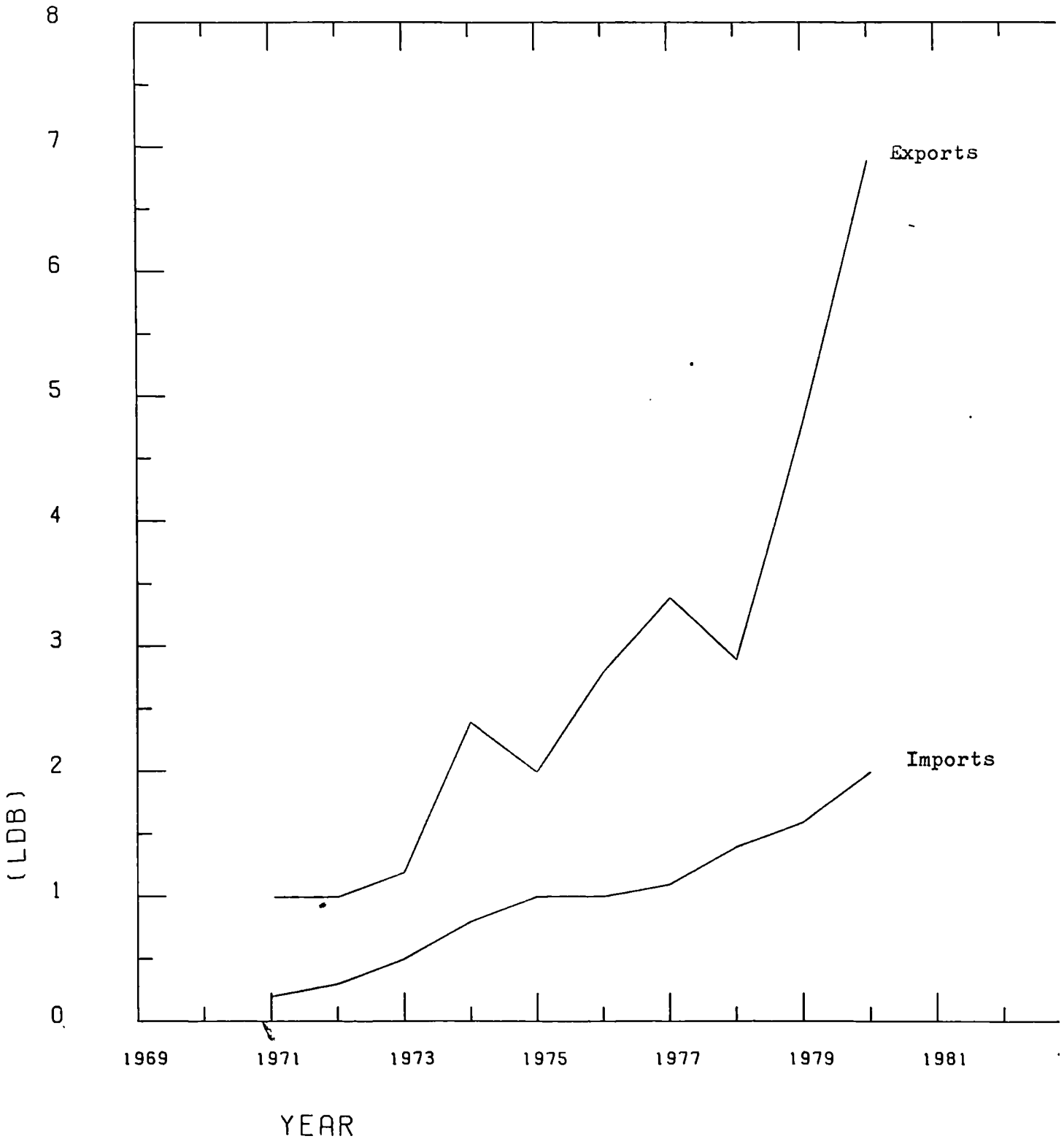
The oil boom which increased domestic earnings substantially, as I have already discussed, resulted in higher demand for goods and services, which domestic production failed to provide. This was coupled with the increasing expatriate population with, a new variety of consumption requirements. The alternative and the easy way, with the help of cash from oil, to cover the gap between rapidly increasing consumption and low levels of domestic production is to depend heavily on imports from abroad. Imports increased from £LM16 in 1958 to about £LM49 in 1962 and then jumped fourfold to £LM205 in 1970. However, the massive increase in imports had to be met by the increase in crude oil production and exports. It is shown, in Table 6.11, that nothing in Libya has ever increased as much as oil revenues did. It had increased from £LM35 in 1962 to nearly twice as much in the very next year, and from £LM231 in 1967 to £LM567 in 1970.

During the second decade of the oil boom (1970s), the Libyan balance of trade and balance of payments continued their dependence on oil exports. But, in addition, the 1970s showed how vulnerable is the Libyan economy through its dependence on a single commodity for foreign exchange earnings, especially with increased imports. This effect is quite clear from the fluctuations of the balance of trade and balance of payments during the 1970s.

Figure 6.7 shows that the value of exports rose in each year during the 1970s, except in 1972, 1975 and 1978, in spite of falls in volume which, as will be argued in Chapter 7, was a result or an outcome of the game between Libya and foreign oil companies. The tightness of oil revenues to oil

FIGURE 6.7

Libyan exports and imports (LDM) 1971 - 1980



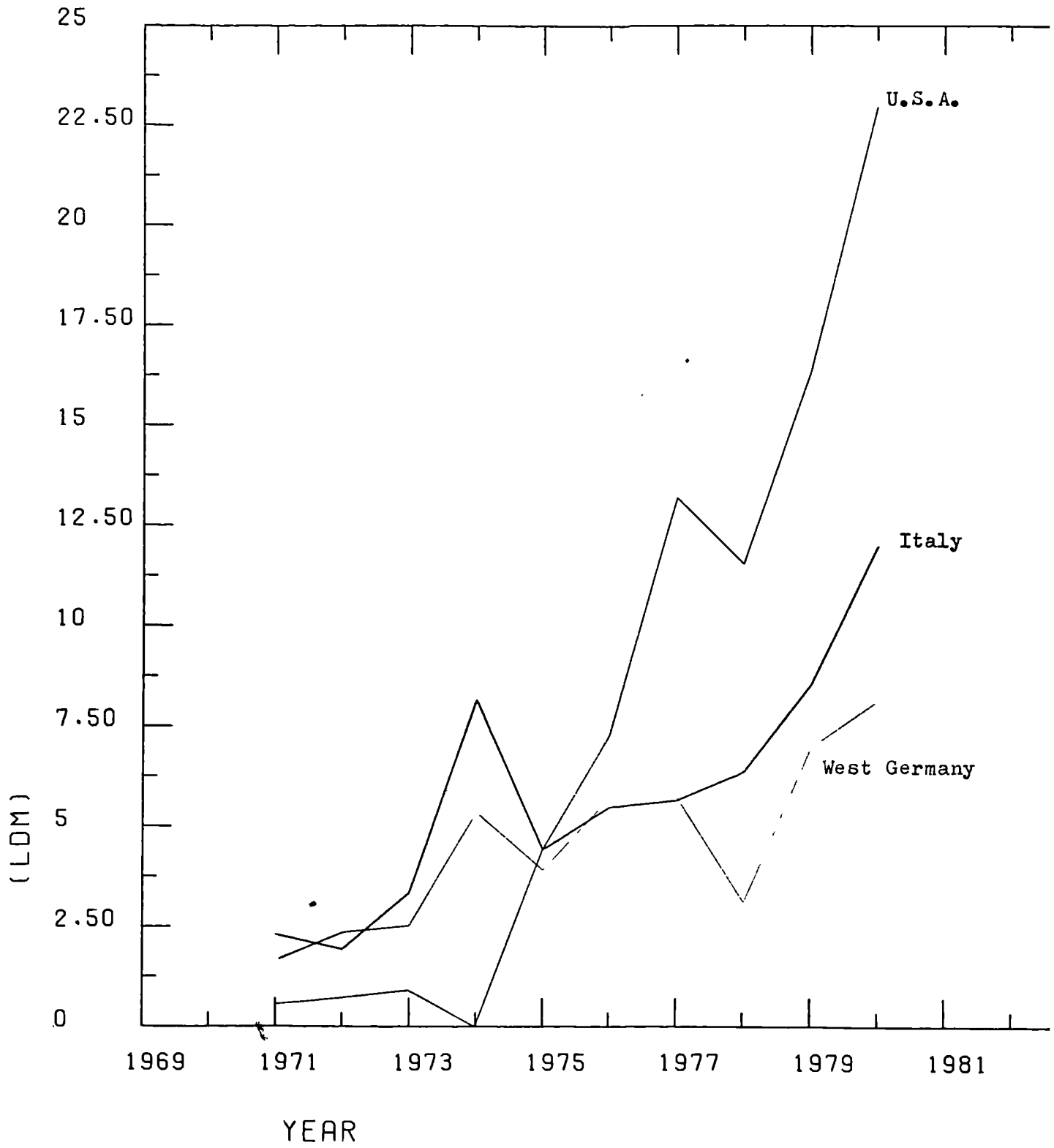
prices can be beneficial to oil producers at some times, but on the other hand it can have a negative effect at other times. For example, while the increased oil prices in the 1970s was a blessing to exporting countries' economies, it was followed by a period of hardship when oil prices tumbled down in the 1980s. However, although Libyan oil exports declined in 1974, its value doubled because of the great price rises, but fell back again in 1975 owing to lower prices. Soon in 1976 oil revenues recovered because of the greater volume of exports.

Exports rose by 19.5% in 1977, but figures for 1978 show a decline in total exports of 13.3% from LD3,381.8 million in 1977 to LD2,932.9 million, due to cutbacks in oil production and demand. The main destination of the Libyan crude exports are shown in Figure 6.8. However, in 1979 total exports increased to LD4,761.9 million and in 1980 to LD6,489.1 million as a result of increased world demand for oil, in addition to price increases imposed by Libya. This was in spite of an 18% cut in oil supplies effective from April 1979 [Lloyds Bank 1980 p.14]. Exports continued to fall during 1980 and 1981 owing to the slump in world demand. Despite increased crude extraction by oil companies in 1981, export earnings are likely to continue to be depressed for some time as demand for oil continue to fall. As mentioned earlier, this has a negative effect on the Libyan economy through its heavy dependence on oil revenues. The reluctance of the Libyan authorities to reduce their oil prices in line with their non-OPEC competitors, especially the UK and Norway, is also contributing to the reduction in revenues [Lloyds Bank 1982 p.22].

The second point showing the increased demand for goods and services can be observed in the continuous increase in imported goods and services. Imports increased from £L250 million in 1971 to LD1049 million in 1975 and over LD2 billion in 1980.

FIGURE 6.8

Libya's crude oil exports by destination



XAXIS:SCALE AS PRINTED.

YAXIS:SCALE = Y * (10 **-2)

Capital goods in general and machinery and transport equipment in particular are the main import categories. The latter accounting for over 35% of total imports in 1976, and 37.5% in 1977. The highest increase of machinery and transport equipment imports was in 1979 (42.5% of total imports), as shown in Table 6.12 below.

Table 6.12

Percentage Distribution of Value of Libyan Imports

by Commodity Section: 1971-1980

Item	1971	1976	1977	1979	1980
1.Food and live animals	19.0	13.3	17.0	15.1	16.9
2.Beverages and Tobacco	1.0	0.3	0.5	0.5	0.5
3.Crude materials inedible	2.3	2.1	2.6	1.9	1.8
4.Mineral fuels,Lubricants and related materials	3.3	2.7	0.6	0.7	0.7
5.Animal and vegetable oils&fats	2.2	1.2	1.2	1.1	1.9
6.Chemicals	6.0	3.9	3.6	4.1	5.4
7.Manufactured goods	20.8	27.4	21.9	23.3	24.1
8.Machinery and transport equip.	29.2	35.3	37.5	42.5	38.0
9.Miscellaneous manufac.articles	16.2	13.8	15.1	10.8	10.7
Total	100	100	100	100	100

Source: Ministry of planning,*Trends of External Trade*, Feb.1982,p.17.

The imports of food and live animals dropped from 19% of total imports in 1971 to 13.3% in 1976, then increased to 16.9% in 1980 showing the shortfall in domestic agricultural production that existed. The importance of such imports should be reduced as the agricultural development schemes become operative. There has been a reduction in the value of fuels and chemical imports, as a result of petrochemical and refinery industries, and the operation of the new chemical works at Abu Kammash (in the West of the

country near Zuara). Similarly, the increase in livestock production should reduce imports of animal products.

The Libyan Government is increasing its domination of the import trade, with the growing number of public trading bodies curbing the role played by the private sector. Legislation introduced in January 1979 declared that all permitted imports would in future require an import licence and only certain organizations would be granted these licences. These include public sector establishments, organizations and companies, co-operative societies, and establishments which have been taken over by workers' committees. The power of the public trading bodies had already been increased under a directive issued in May 1978. This allowed the state organizations to monopolize totally the granting of import licences within their sector of operation, thus making the function of private sector merchants redundant. Not only is the power of the state trading organizations becoming greater within their operations area, but their sphere of activity is also increasing.

These government monopolies include the National Supplies Corporation (which controls imports of Wheat flour, Wheat, Barley, Rice, Sugar, Tea, Salt, and various other commodities), the General Tobacco Corporation, the National Oil Corporation, the General Corporation for the Import and Marketing Agricultural Tools and Equipment and the National Pharmacentical Company.

In September 1975 the government took over the importation of motor cars and later also commercial vehicles. In November 1977 a state import authority for clothing was established, and the Electronics General Company was set up in 1977 as sole importer of electronic equipment (including radios, televisions, etc.). Other goods in which state organisations have an import monopoly include most telecommunications equipment and building

materials, fertilizers, tyres and batteries, leather goods (including footwear), computers, furniture, pottery and glass. In 1979 it was announced that gold and other pecious metals could only be traded by the Gold and Metals Company.

However, the dependence of Libya on exports of oil and imports of capital and consumption commodities confronts the country with the problem of international fluctuations of prices (imported inflation). This has led to more difficulties in implementing and evaluating development projects [Elhuni p.23]. However, oil activities have been developed very rapidly, and this development, in addition to the dramatic surge in oil prices during the 1970s, has rewarded the country with substantial amounts of hard currencies. Capital in the form of revenues has to be used in developing the country's non-mineral as well as mineral resources. Such developments, as will be argued below, is the only substitute for oil when the latter runs out. This development takes different forms such as infrastructure, natural resources, agriculture, industry, health, education etc.

6.3.4 Sectoral development:

Throughout the past two decades development spending, which is highly depended on oil revenues, has risen rapidly in all sectors. However agriculture and industry, the backbone of the rural sector, have received the highest priority, followed by housing, communication and transport. Although these sectors differ in success, they have faced some real problems which could not be easily solved by pouring capital into the economy. Here we deal with the development of the main sectors of the economy, showing how far they overcome some of the problems facing them.

1- Agriculture: Since the base of the economy, before oil, was agriculture, it was natural that the economic impact of oil would be felt most acutely in that sector.

Despite limited access to funds, Libyan agriculture had achieved some progress before the oil era dawned. In the first useful estimate of national income produced by the Ministry of National Economy in 1958, agriculture accounted for 27% of the value added, as I discussed in Chapter 5. In that year the sector employed 72% of the working population. Domestic agricultural produce also fed the bulk of the Libyan population and provided a surplus for export. The impressive record of the private sector was remarkable. [McLachian 1982]. The rush because of oil attracted far more people than the modern sector could absorb. The result was decreased farmland in many parts of the country, and increased crowding in urban centers, as seen from the population movement throughout the last two decades. As an example, Table 6.13 shows the net migration movement to Tripoli and Benghazi in 1973.

Table 6.13

Migration in and out of the Main Towns in Libya:1973

Migration	Tripoli	Benghazi
In-migrants	141387	60610
Out-migrants	28928	16244
Net-migration	112458	44366

Source: Ministry of Planning, *Internal Migration*, Tripoli, 1973, p.61.

One immediate result of this situation was a sudden increase in the demand for foodstuff in these centres. This came both as a result of increased urban population and of higher per capita consumption, due to higher disposable income among Libyans and foreigners serving the oil industry and related activities.

Under normal conditions this would provide a strong stimulus for agricultural production to increase in response to higher prices for

foodstuffs. But such a healthy development could not take place for two reasons:

(1) The low state of technology in agriculture.

(2) The higher profits on investment in the trade and service sectors of the economy.

The inflow of oil revenues to Libya after 1961, albeit on a modest scale, induced a gradual expansion of government intervention into the conduct of the agricultural sector. This went on parallel to the dynamic of change within the sector itself brought on by the re-occupation of former Italian farms and increasing market participation by Libyan farmers.

Constraints on agricultural activities arising from severe environmental problems apply throughout the country, being only slightly less constricting in the North than in the South. Effects of adverse natural conditions are demonstrated in a UN team assessment of land use in Libya summarized in Table 6.14 below.

Table 6.14

Land Use in Libya

Land use type	Area(skm)	% Of total
Urban	500	0.03
Agriculture-arable and orchard	18,000	1.10
Agriculture-pasture and grassland	70,000	4.00
Forest and scrubland	5,000	0.30
Wastelands	1,666,000	94.57
Total	1,760,000	100.00

Source: *National Physical Perspective Plan 1981-2000*, UNDP, Tripoli, March 1979, p.36.

The concern of the ruling authorities in Libya during the present century has largely been with the arable and orchard farming, comprising a mere

1.1% of the country's land surface. The whole of this land is concentrated in the Western and Eastern regions. 78% in the West of the country, 21% in the East and just 1% in the South [Bansil 1979 p.2].

Government control of incoming oil revenues no doubt acted as a spur to those in authority to assist that area of the economy felt to be vital to the interests of the state and all ordinary members of the rural community. Adoption of the development plan for the years 1963-68 formalised the apparent need to involve the arms of government in agriculture.

In 1961, the government initiated long-term agricultural loans on easy terms, for the purchase of agricultural land from the Italian settlers who had acquired it during the Italian colonisation. This policy began with a credit scheme of lending up to 50% of the estimated sale of the farm, but a year later it was modified to lend up to 100% of the value of small farms, the value of which did not exceed £L1000 [Libyan-London Universities Joint Research Project 1969 p.13].

Although this credit policy helped to transfer the ownership of many farms to Libyan nationals, the economic and social price paid for this achievement was high and could have been avoided. The first result of this credit policy was a sudden increase in the value of agricultural land owned by Italians. Liberal credit terms encouraged many people to enter the market as competitive buyers, while the supply side was relatively organised and inflexible. This had the effect of further raising the cost of agricultural production and diminishing its competitive position in the economy. Another detrimental aspect of this policy was the tendency to grant these long-term credits to urban people who had neither the experience, nor the necessity, to maintain and improve the productive capacity of their newly acquired farms. Since they had other sources of income, either in government or the tertiary sector, they generally looked

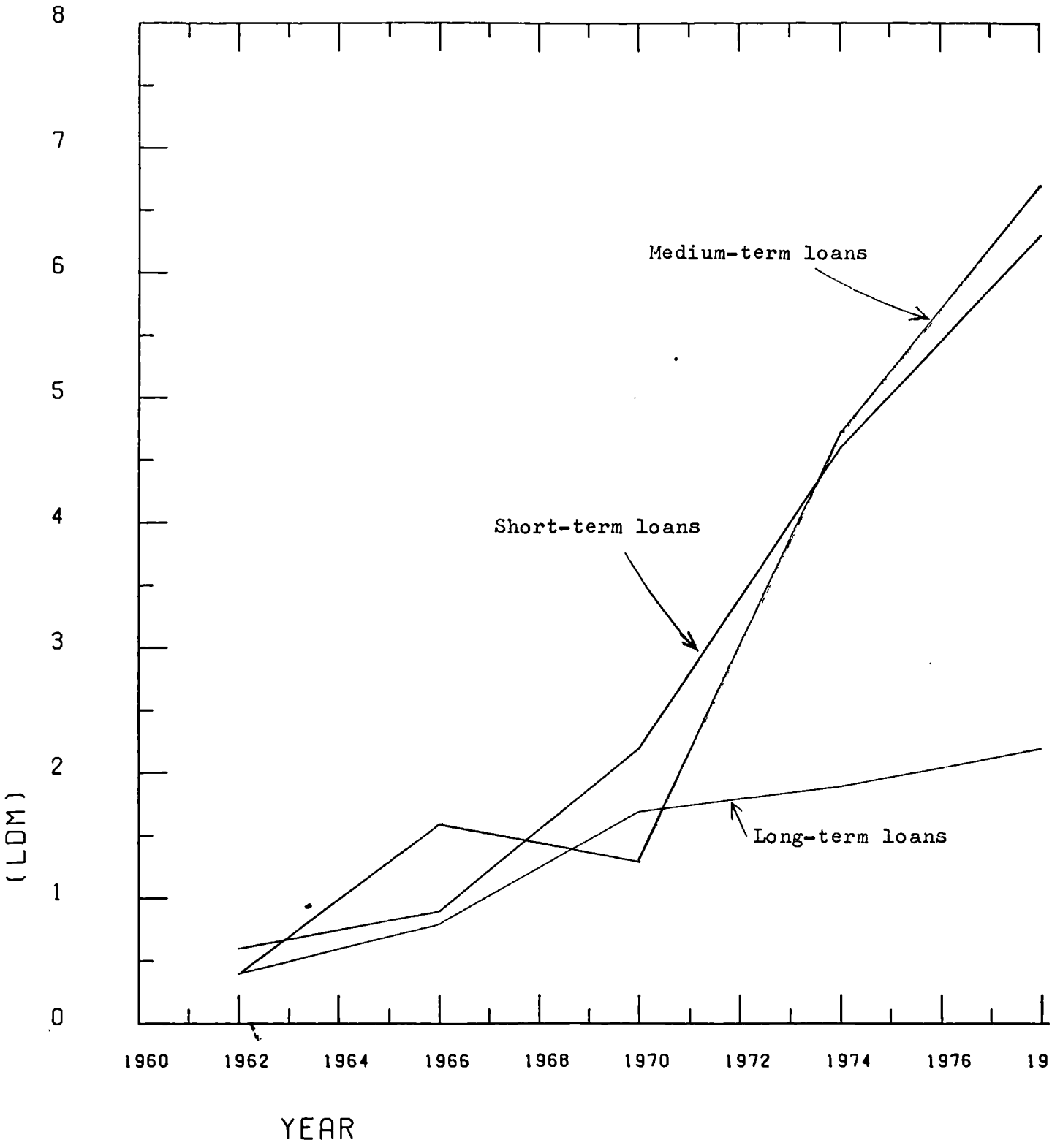
upon their purchases of these farms as good investment outlets in the face of rising inflationary trends initiated by the oil industry.

The government tried to increase agriculture's contribution to the national economy. Farmers were offered low-interest fifteen-year loans by the National Agricultural Bank (founded in 1957), as well as subsidised farm machinery and equipment. Repayments did not start for five years and were then made in ten annual instalments. The bank also bought olive oil, almonds, and groundnut surpluses, generally above world prices, to create an anti-inflationary buffer stock, and encouraged farming co-operatives. From 1961 onwards the bank was advancing more than £L1 million a year in loans which was quite impressive as shown in Figure 6.9 below. The bank also ceased charging interest altogether by 1966.

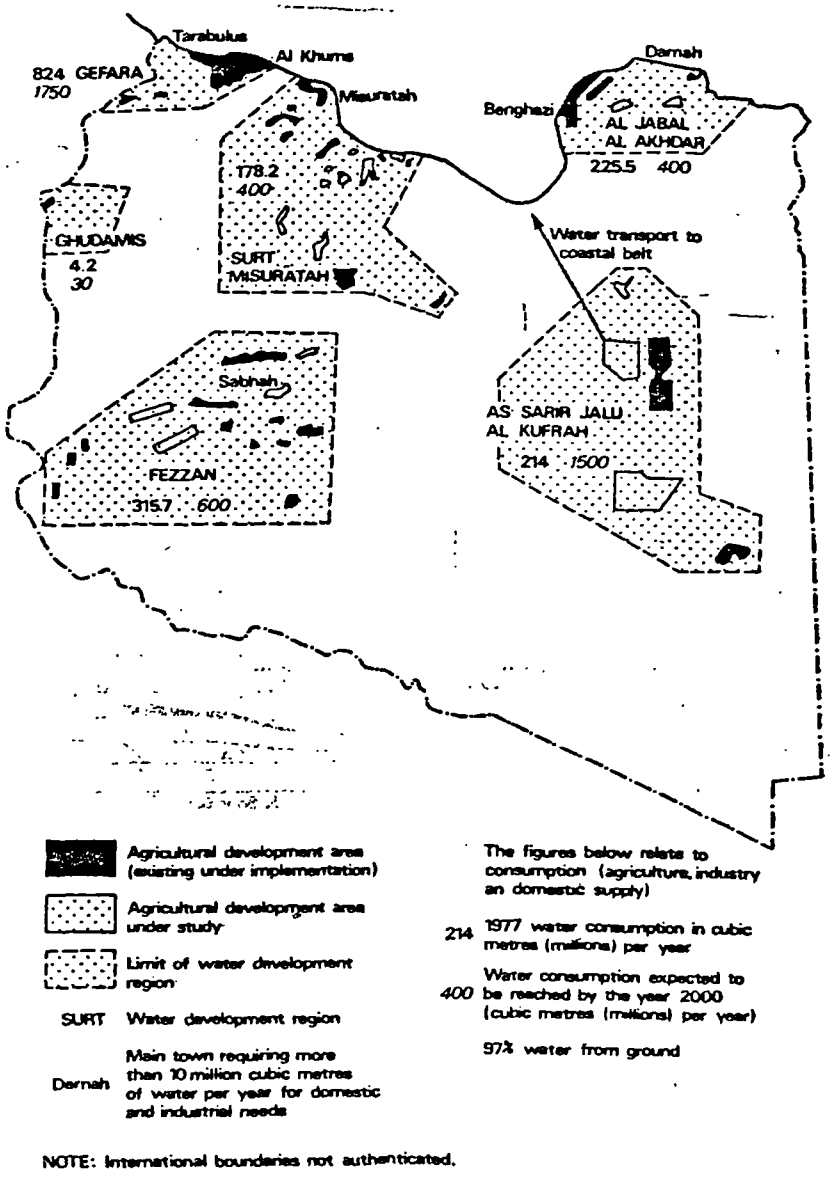
Such activities encouraged a rapid rise in agricultural output, estimated at 4.5% a year during 1962-67, not least through intensification of irrigation in the oases and former Italian farms, together with spread on to the extensive margin in areas such as Ajaylat. Rapid and accelerating depletion of Libyan northern water resources was experienced as a consequence of this investment. The decisions of the past two decades at national and individual farmer level have clearly implied that water resources were not considered to be limited, and further that the investment of capital to raise and distribute water create a productive combination of those factors which might lead to viable and even profitable agricultural enterprises. Map 6.1 summarises a study by Pallas [1978 p.88] of Libyan water use in the mid-1970s and the anticipated use by the end of the century. Pallas noted that 97% of water was drawn from the ground in the mid-1970s. Libya has no flowing water and rainfall is significant only in small coastal tracts of the Gefara plain and the Jabal Nafusah in the North-West and in the Jabal Al Akhdar in the North-East. Rainfed farming

FIGURE 6.9

National Agricultural Bank loans (LDM) 1962 - 1978



Map (6.1)



Source: Allan, J., Libya Since Independence, (1982), p.27

is limited to the Gefara, and to the coastal and adjacent uplands, an area in all totalling about 100,000 square kilometres.

Libya's groundwater falls into two categories:

(1) There are renewable resources in the coastal plains of Tripoli, Benghazi and near Misuratah.

(2) In the South there are substantial fossil water resources which have been dated to be between 6,000 and 30,000 years old.

The safe yield of an aquifer is equivalent to the average annual recharge. The recharge is in turn directly related to the annual precipitation of the catchment. It has taken many years to arrive at a Figure for the Gefara plain system, but by 1980 it was generally agreed that the safe yield of the system was 100 million cubic metres [Allan 1981]. By 1940 this safe yield had probably begun to be exceeded as a progressive decline in groundwater levels was evident [Cederstrom and Bertcuola 1960].

The trend in water extraction continued at the same rate until the early 1960s, when additional pumping began on the private sector holdings created as a result of the sale and subdivision of large Italian farms. Observation well records of the Soil and Water Conservation Department of Ministry of Agriculture clearly demonstrated the trend by 1968 [Allan, Maclachlan and Penrose p.38], and a one metre per year rate of decline at points 40 kilometres from the coast was obviously going to become a three metres per year annual decline in a few years time. In the event the three metres per year rate occurred by 1973 and five metres per year was being recorded by 1980. These data and other indirect measures of water use suggest that the rate of with-drawal in the Gefara system was running at 600 million cubic metres per year, or about six times the rate of recharge.

The impact on the groundwater resource has been severe. By 1981 the

water at points such as Bin Gashir and Suwani Bin Yadim had been pumped to below sea level so that the gradient in the aquifer ran South away from the sea. The problem of sea-water intrusion had already affected coastal farms, and by 1980 it affected the wells six kilometres inland which supply Tripoli city.

In the past, when standards of living were lower and aspirations less than they presently are, ingenious plans were elaborated for maximum use of agriculture for generating employment and income. Agriculture had, by 1980, lost its potential in both these roles. This arose not simply because of changed attitudes towards agricultural employment by the Libyan population, but because there were real alterations in the physical resource base between the 1950s and the 1980s. The boom in agriculture that affected the 1960s and 1970s systematically exploited limited and fast declining water reserves in the Northern areas of the country. Expert opinion indicated that radical reduction in water use in the Gefara was vital if permanent damage was not to be sustained. In effect, richest agricultural area in Libya, and one of sophisticated and productive agriculture, was at risk of losing its irrigation potential. Government plans for the Gefara coastal strip under discussion in 1980 and 1981 included a land redistribution programme, enforcement of full-time farming, a managed crop rotation, and greater state control of day-to-day farming activities. All of this was designed to reduce water use in agriculture by two thirds.

Investment in irrigation has substantially increased production since 1960, but the style of investment has not been consistent with a sustained use of water resources. The technologies deployed have made larger volumes of water available than was possible by traditional methods, and to some extent there has been an appropriate substitution of capital for labour, of

which Libya is also short. But, according to Allan, to date the investment has not been directed to substituting for water, in the sense of introducing irrigation systems which will allow one cubic meter to support two or even three times the area of crops currently supported [Allan 1982 p.10]. Capital remains a pre-requisite for the deployment of the expensive trickle and glass-house technologies which are the only viable irrigation options for Libya.

(2) Industry: Because of agricultural difficulties, and in order to diversify the Libyan economy, priority is now given to the industrial sector, both for light and heavy industry. Industrialisation, especially with a bias towards heavy industry, has a natural appeal for a country undergoing its own version of socialist transformation. The strategy aimed at maximising the advantages of the Libyan current capital surplus to create a sector that will provide employment opportunities, treasury revenues and foreign exchange earnings after oil exports have diminished drastically, or ceased altogether.

It was the service industries, and not manufacturing, that created the main demand for labour. The development of manufacturing industries was slow and on a limited scale. By 1938, 789 establishments were in existence employing some 20,000 industrial employees in the country [Wright 1979 p.271]. The main industries, both then and after independence were, small food-processing plants, garages, and workshops. The more important establishments were those which produced building materials, metal products, agricultural foodstuffs and tobacco.

Although many of the original factories were destroyed during the Second World War, much the same light industrial structure emerged during the 1950s, but with more local ownership. During the 1950s also, two industrial training centres were established in Tripoli and Benghazi, and

according to a 1956 census there were then 3121 industrial establishments in Libya, 87% of which employed fewer than 10 people. Even in the 1960s the tobacco industry, employing about 4,000 in growing and processing, was the second largest industry after oil. A Ministry of Industry was formed in 1961 to supervise state-owned factories and to plan the development of private and nationalised industries. In the first five-year plan (1963-68) almost £L7 million were allocated to this sector. The aims were as follows:

(1) To raise the present level of production, in quantity, kind and quality.

(2) To promote consumption of Libyan manufactured goods so to reduce dependence on foreign goods.

(3) To create an export market and a higher level of employment.

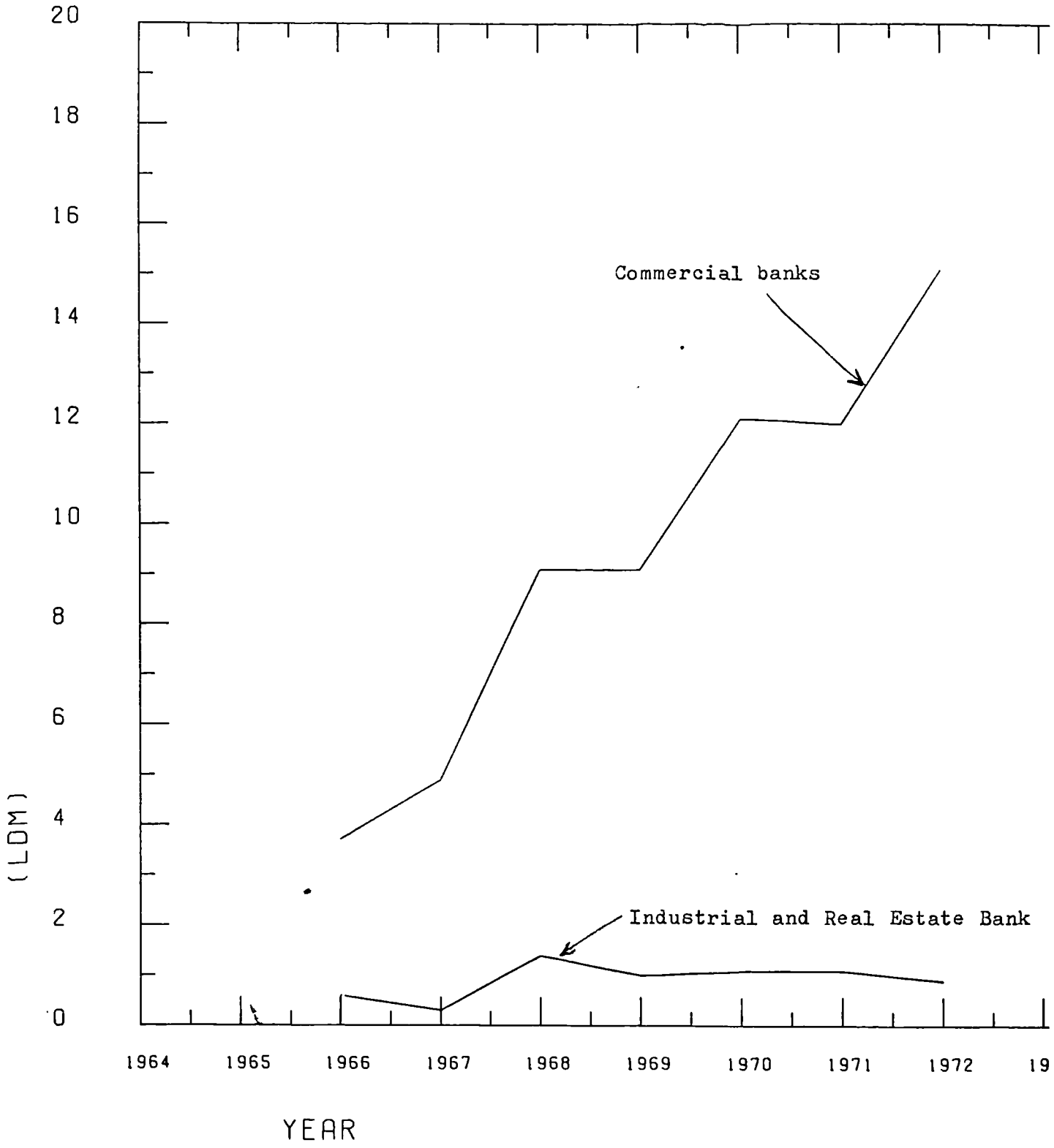
Of the allocation to industry, £L5 million were set aside for credits, and an Industrial Development Organisation was established. In 1965 this became the Industrial and Real Estate Bank, authorised to lend 60% of its £L10 million capital free of interest. Up to September 1970 it had lent LD11.7 million, and in 1971 it lent only LD1.1 for industrial purposes. Commercial banks also made large contributions to Libyan industry, before and after the establishment of the Industrial and Real Estate Bank. This is shown in Figure 6.10 below.

Most private investment was made either in housing and real estate, or in oil industry contracting-transport, servicing, equipment-hire, and catering, or in foreign trade. Thus the government had to play the part of industrial pioneer and at the same time provide the bulk of the funds for the private sector's modest industrial development ventures.

The role of the industrial bank, which had previously been a major lender to the private construction industry and food processing sector, has

FIGURE 6.10

Industrial loans (LDM) 1966 - 1972



declined in recent years, and in 1981 its real estate operations were taken up by a new Real Estate Investment and Savings Bank established to encourage construction and personal savings linked to property [Middle East Economic Digest (MEED) Feb.1981].

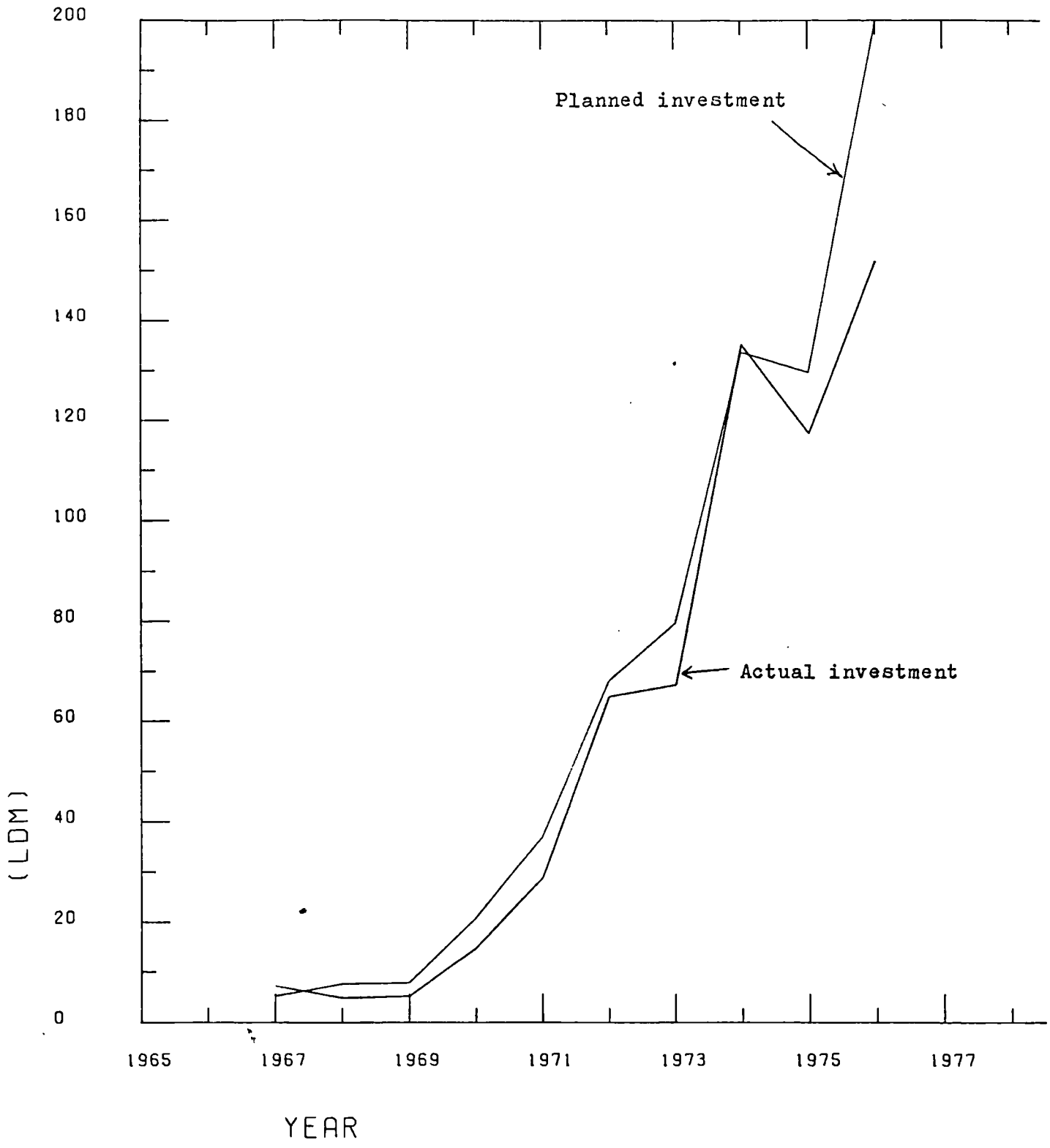
Increased government expenditure on industry was accompanied by a corresponding decline in private sector investment. In 1968 private sector investment in manufacturing was valued at LD4.2 million compared to public capital funding of LD0.9 million. Although by 1972 private sector investment had risen to LD7.8 million, the government in this year supplied LD11.7 million to industry. In subsequent years direct private sector investment has fallen away completely [Allan 1982 p.58]. Private construction has undoubtedly remained more buoyant than activity in any other industrial subsector.

Since the Libyan Revolution of 1969, the government attitude towards industry has changed dramatically, with more attention being paid to the development of public sector projects. In 1970 the National Public Organisation for Industrialisation (NPOI) was established as the major organ for implementing the public sector's industrial development plan. Initial capital of NPOI was put at LD6 million, but this has been increased many-fold in succeeding years. In its first year of operation NPOI was involved in five projects; by 1977 the number had risen to 43, and by 1980 NPOI was to have funded 91 projects with a total capital investment of LD500 million [Al Muhdawi 1981 p.253]. The rising value of planned and actual government investment in the Libyan industrial sector that occured after the Revolution is shown in Figure 6.11 below.

The introduction of government investment in industry on a large scale has had the quite deliberate result of redressing the previous heavy bias in favour of small industrial establishments. 19% of planned investment

FIGURE 6.11

Planned and actual government investment in Libya's industry (LDM)



was allocated to the industrial sector in 1976-80 development plan, with this leap being made possible by the important change in investment priorities towards major capital intensive heavy industry projects. Libyan determination to industrialise is even more firmly stamped on the 1981-85 plan, the second plan of Economic and Social Transformation, in the form of a 21.5% leading investment allocation [MEED Jan.1981]. The subsectoral breakdown in Table 6.15 shows that industrial metallurgy and petrochemicals in particular, are to be the main recipients of this huge capital expenditure.

Table 6.15

Investment by Industry Groups During 1981-1985 ($m) in Libya

Industry Group	Total	Structure(%)	Growth(%)
1.Food industries	536.4	6.2	16.4
2.Textiles and leather	223.6	2.6	16.3
3.Wood and furniture	6.8	-	7.6
4.Paper and printing	25.3	-	9.7
5.Chemicals	657.7	7.6	35.2
6.Petroleum products	837.7	9.6	21.1
7.Petrochemicals	2,195.4	25.3	38.9
8.Building materials	702.3	8.1	13.9
9.Metallurgy	2,742.9	31.7	60.0
10.Metalworking, engineering & electrical equipment	609.7	7.0	28.9
11.Other manuf. industries	168.9	1.9	3.4
Total	8,706.7	100	21.6

Source: Secretariat of Planning, *Draft Plan*, [1982].

The main obstacles to Libya's industry can be summarised as follows:

(1) The small home market for industrial products.

(2) The shortage and cost of skilled labour.

(3) Lack of experienced management.

(4) Competition from foreign goods.

(5) The need to import many raw materials means that industry needs state aid and protection for healthy survival [Wright 1979].

Nevertheless, refining oil locally for export is intended to increase the return to Libya per unit of hydrocarbon exported, which in turn should reduce the need for high crude exports to fund the country's budget, and so extend the life of Libyan oil reserves [Baker 1982]. If Libyan industry is

unable to run without subsidies from the general budget, it will clearly not have satisfied its major objectives of becoming an alternative source of income to crude oil exports.

3-Infrastructure: In Libya, oil revenues has transformed not only the productive sectors (agriculture and industry), but the entire economy. It has affected the style and the extent of the development of transport, communication, and housing.

Governments with large oil revenues to dispose approach the provision of roads and related infrastructure differently from those operating on restricted budgets. In addition, the expectations of the people participating in the fruits of an oil economy are high and these high expectations extend to the type of road, sea, and air network, as well as telecommunication and housing.

Transport was amongst the sectors to attract investment in the first development plan (1963-68), and as a result of the schemes initiated by the plan, 868 kilometres of road were constructed by 1968 and 3400 km. were in the process of construction, including the coastal highway (1769 km.). Other transport facilities were improved, such as the handling capacities of the ports of Tripoli and Benghazi. New storage areas and quays were constructed and modern equipment for handling cargo was installed. Airports were also improved, new runways constructed, and new aircraft acquired.

Allocations to the development of transport totalled LD71 million (21.1% of total development allocations), placing transport second in importance after public works (24.4%). The LD71 million allocated to transport was not spent and only LD53 million was in fact expended [National Accounts 1971-1978], representing 17.8% of total development spending. A reason for the shortfall was the difficulty of mobilising investment before the

appropriate studies had been carried out, and it was not until the mid-1960s that a comprehensive study was completed by the consultants Doxiadis.

In the 1971-73 period LD113 million were allocated to transport and LD76 million were spent. Although the budgeted targets were not reached, actual spending in the 1971-73 period ran at a rate four times that achieved in the earlier period at current prices. Transport expenditures were more than sevenfold those of 1963-68 at current prices. The average annual expenditure was LD128 million, a high figure even taking into account inflation and a very high figure in terms of the absorptive capacity of the economy.

In the 1976-80 development plan the transport sector continued to occupy third place, after industry and agriculture, but with a further reduction to total 12.6% of proposed spending. Table 6.16 shows that the investment of the 1976-80 period brought substantial improvements to the nation's communications. Most dramatic were the improvements in telecommunications. Sea transport responded to the investments and there was steady improvement in the road network.

Table 6.16

Development of the Transport Sector in Libya 1975-80

Sub-sector	Unit	1975	1980	%Change
Paved roads	km	7747.0	10,700.0	38.1
Cars per kilometer	No	37.8	62.2	64.5
Civil planes	No	10.0	17.0	70.0
Air passengers	No(000)	559.0	1,125.0	100.1
Commercial ships	Ton(000)	18.3	39.3	114.0
Oil tankers	Ton(000)	412.0	766.0	86.0
Ports capacity	mn ton	3.0	7.0	133.3
Telephone/person	No	1.8	6.0	290.0

Source: Secretariat of Planning, *The Evolution of the Five-Year Development Plan*, [1980].

In its efforts to decentralize the economy effectively the government aims to improve the telecommunications network. In the 1981-85 development plan, telecommunications development is allocated $1.17 billion and will involve the improvement of automatic exchanges and the microwave system, as well as the introduction of a new international telephone exchange and telex facilities for Misuratah, Derna and Sabhah [Lloyds Bank 1982].

It is not only in the transport sector that oil revenues play an important role. They have also been the basis of the other sectors of the economy. The role of transport in making such growth possible is just as important for the services sector as for the productive sectors. Transport will play an essential role in sustaining the level of construction, the proposed growth in agricultural and industrial production, as well as further developments in the services sector.

The impact of oil revenues on the Libyan economy is also visible from the growth of personal incomes and wages, as will be discussed below.

6.3.5 Personal income and wages:

I argued in Chapter 5 that pre-oil per capita income and Gross Domestic Product as a whole were very low. Per capita income was about £L14 in 1953. This was one of the most depressed incomes in the world at that time. Wages, as will be argued below, were also very low. It is only since the export of oil in commercial quantities in 1963, per capita income and wages have begun to rise with the increased oil revenues. As I argued earlier in this chapter, per capita income increased from £L156 in 1963 to £L642 in 1970, and over to LD1500 in 1974. Because of the continuous increase in oil revenues since then, there have been no restrictions on wages and salaries except the rise in prices for goods and services, as will be discussed below.

In Libya, capital is relatively abundant in the form of financial revenues that accrue to the government from oil. But capital alone cannot induce economic progress. Complementary resources are required, the most important being labour, especially skilled labour and qualified management.

The real employment problem as far as unskilled labour is concerned is not so much an issue of quantitative supplies but one of allocation and policies. The expansion of a modern sector (oil industry, manufacturing, transport and trade) as well as the development of a progressive agriculture, depends on the existence of a pool of professional and skilled workers and on the presence of a stable and disciplined group of unskilled workers. A drift of rural workers to towns and cities, even if it depletes the agricultural reserve of labour, is not necessarily a bad thing. The problem must not be looked at through the farmers' eyes (they may regret the days when labour was abundant and cheap) but in the broader context of allocation and growth in the whole economy. If the labour market is competitive and if obstacles to mobility are not too obstructive, workers

will tend to move from the relatively inefficient to the relatively more efficient sector or sectors in the economy, as the latter are likely to offer higher wages. Re-allocation favours the efficient activities and thus benefits both the individual worker and the economy. There is no necessary reason why a drift to towns and cities should have adverse effects on the economic performance of the country.

The 1964 Population Census showed that the recorded labour force includes some 400,000 workers. Slightly less than 26% of the population participated in the labour force; this is rather low. The participation of children is lower than in most developing countries and than in other Middle Eastern countries. That of women, according to the census, is almost negligible, as I discussed in Chapter 5. The low participation rates for children are due to the expansion of schooling, which is generally seen as a sign of progress. In the case of women, traditions may play an important role, but traditions are affected also by economic conditions [Deeb and Deeb 1982]. In rural areas women and children may work for short periods only during the seasonal peak of agricultural demand, and this work, though limited in time, is usually very significant in terms of its contribution to output. Moreover, many agricultural operations such as tending animals or processing farm products, are part of the normal duties of the housewife and are not considered as "*employment*" by the Census. From an economic point of view however, these duties represent a genuine contribution to the productive effort of the community.

In most developing countries wage rates for unskilled workers are higher in the modern sector than in agriculture. The Libyan-London [1969] joint project study showed that in 1968, Libyan agricultural wage-rates were higher than industrial rates. But construction wages were highest, probably because of the nature of this sector, which requires more physical

effort compared with other work. Typical wage rates are shown in Table 6.17.

Table 6.17

Average Wages in the Main Sectors in Libya (1968)

Sector	Average Wages(£L)
Agriculture	1.000
Oil industry	0.750
Government	0.700-0.800
Construction	1.200

Source: Libyan-London Universities Joint Research Project [1969], p.162.

Before the oil era, Libya did not constitute an exception to the general rule that wages are lowest in agriculture. The wage level in agriculture was very depressed, between £L0.100 and £L0.150 in 1952-54, and the rural/urban wage differential, although small, favoured the emerging modern sector. When, in 1956, oil companies started exploring the desert they offered employment at wages substantially higher than the rates prevailing either in agriculture or industry, and the wage-gap between the traditional and modern sectors widened considerably. Between 1956 and 1959 wage rates in agriculture rose from £L0.140 to £L0.180, as Table 6.18 shows, while oil companies were recruiting unskilled labour at rates varying between £L0.250 and £L0.400.

Table 6.18

Median Agricultural and Oil Industry Wages in Libya

1956-1959

Year	Agriculture (£L/d)	Oil industry (£L/d)
1956	0.145	0.250
1959	0.180	0.400

Source: Mabro [1970], p.327.

In later years, 1960-62, agricultural wage rates rose sharply to £L0.400 but it is doubtful whether the increase represented a real gain to the workers, for prices were rising sharply too. These were very difficult years for the State; the level of expectations was high, the operations of the oil industry were exerting strong pressures on the price-level and the government was facing demands for higher wages and for the opening up of new employment opportunities. The State, however, was not in a position to satisfy these demands, not having received as yet any substantial revenues from oil. Rural migrants were flowing to the towns, amplifying a movement that seems to have started before the beginning of the oil era and that gained momentum in later years.

Other figures help to illustrate how low wages were in agriculture in relation to other sectors of the economy. In 1971, agriculture employed around 30% of the Libyan labour force, but the agricultural wage bill represented only 2% of the total wage bill for all sectors. (We should remember that workers in agriculture also receive a significant portion of payments in kind such as meals, and therefore, considering only money wages paid to agricultural workers is misleading). On the other hand, the construction sector employed nearly 7% of the labour force while its employees received about 17.1% of the total wage bill [National Accounts 1962-71].

The result is that the rural surplus of labour was transferred into the towns. Because of their small size, neither manufacturing nor the oil industry could be expected to absorb the urban surplus. The private services sector may have expanded somewhat, offering means of subsistence to the newcomers, however its capacity is limited. There seemed to be no other option for the State but to create new jobs in its own departments. When oil revenues started to flow into the Treasury, the Government found itself able to respond to the demands; the salary scales were revised and adjusted upwards in 1964 and in 1966, and official employment considerably expanded. Recruitment was not restricted to the towns but extended to the rural areas also. To a large extent, the policy was aimed at distributing the oil revenues to some segments of the population. From then on, wages paid by the Government to unskilled workers were as high, if not higher, than the wages paid by oil firms.

As from 1964-65, the oil industry ceased to be the wage-leader of the economy, this role being taken over by the State. The reversal of the agriculture/industry wage differential, which seems to have taken place around 1964/65, can be explained by a combination of three factors:

(1) Internal migration, which created a small surplus and some unemployment in the towns.

(2) The wage and employment policies of the State, which established the rate of £L0.700-£L0.800 as the minimum reward for a relatively easy job. Agricultural wage-rates were bound to rise above this, especially during the seasonal peak when labour is short and the work irksome.

(3) The stagnation of employment in the oil sector.

After 1964 employment in the oil industry failed to expand significantly for at least two reasons:

(a) The passage from exploration to production that took place during

this period is labour-saving in character.

(b) Oil firms started to contract out a number of auxiliary operations such as transport, catering and construction. In earlier years these activities were undertaken by the firms themselves.

The oil sector was thus facing favourable conditions in the labour market, excess supply and a stagnant demand. There were no pressures for higher wages.

The construction sector is in a different position. Construction is a very large employer and demand for labour is expanding continually. The conditions of work on building sites are not very attractive because of the nature of the physical effort required. Building contractors encounter great difficulties in recruiting Libyan labour and wages are consequently high. Their only alternative is, within the limits set by the allocation of work permits, to employ foreign labour. It is clear that the Government is employing so many workers that shortages of labour for construction, the private sector, as well as for transport and trade are being created. In fact, workers who could be easily absorbed in agriculture and in other productive sectors, are employed by the State. In 1964, 30% of the Libyan labour force was employed by the government [Stanford Research Institute 1969 p.152]. It is difficult to believe that the Government sector is free from disguised unemployment in an economy where jobs and wages are the most convenient means of distributing oil revenues. The evidence supporting this argument is that in the early 1970s more than 60,000 government employees were reallocated to productive sectors, mainly to agriculture and industry.

However, despite the increase in employment supply in the urban centers and disguised unemployment among government employees, wages were gradually increasing. The only constraint on such increases is the increased rate of

inflation as will be discussed next.

6.3.6 Inflation:

One of the undesirable effects of the oil boom on the Libyan economy was the inflationary pressures that accompanied the rapid growth of this sector. The inflationary trend was the result of the disproportionate injections of funds leading to the existence of continued increasing demand for goods and services in excess of domestic output capacity. This condition has been aggravated by the extensive development programmes adopted by the government since the early 1960s. The inflationary pressures are clear from the trends of both the money supply and the cost of living index, as will be detailed below.

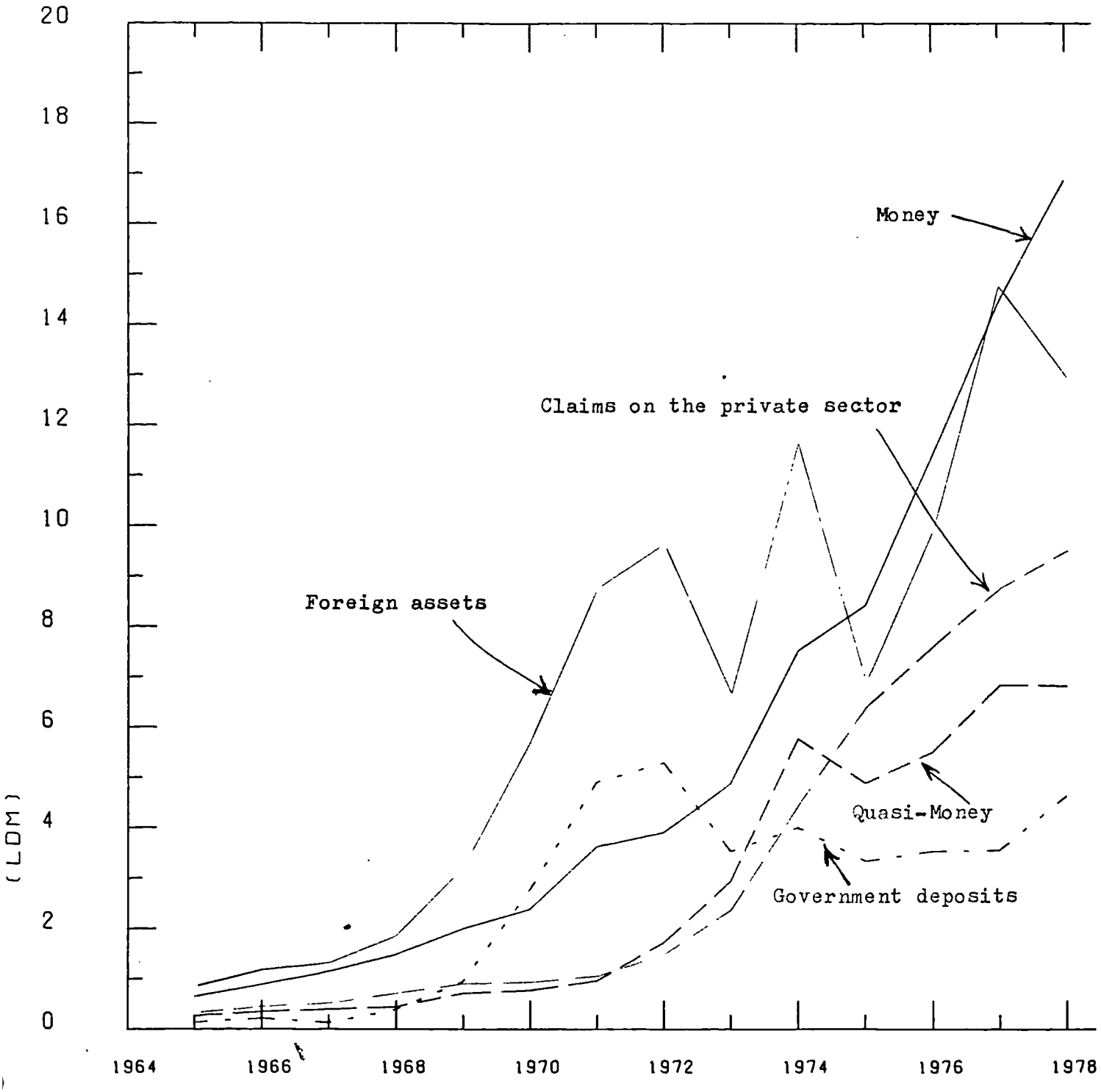
Inflation may increase the price of imported goods and services relative to export prices, as was the case in Libya in the 1960s, which brings favourable terms of trade. This means that Libya can obtain more foreign goods and services. This is equivalent to an appreciation effect of oil revenues in a free market economy, where the demand for a country's currency in the foreign exchange market is large in relation to its supply.

The increasing surplus in the balance of payments, which is indicated by the rising net debt of the banks and monetary authorities, has been reflected in the rapid increase in the gold and foreign exchange assets of the Bank of Libya (central bank), which rose from £L86 million in 1965 to £L190 million in 1968 and £L1446 million in 1977. The increasing revenues of the country are reflected in the money supply, which rose nearly six times between 1962 and 1968, and rose on average 28% a year during the 1970s.

Figure 6.12 below shows the changes between 1965 and 1978 in the assets and liabilities of the Libyan monetary system, which together determine the net changes in the money supply. Money, here defined as demand deposits

FIGURE 6.12

Selected important determinants of the money supply in Libya 1965-78 (LDM)



XAXIS:SCALE AS PRINTED.

YAXIS:SCALE = Y * (10 **-2)

and currency outside banks, is the chief liability of the monetary system, together with savings and time deposits of various kinds (quasi-money), and government deposits. All of these are claims of the public or the government on the monetary institutions.

In creating these liabilities the monetary institutions aquire assets for which they pay out the currency or create bank deposits. The assets may be foreign exchange or other claims on foreigners, or domestic government and private securities of all kinds, or other claims on the public. Figure 6.12 shows two kinds of assets; foreign assets and claims on the private sector, in the acquisition of which the liabilities have been created; money or quasi-money and government deposits, as well as a variety of other liabilities.

It can be seen from Figure 6.12 that the assets acquired by the monetary system rose very steeply until 1972, but the increase in claims on the private sector (primarily credit extended by commercial banks) went up almost as fast as foreign assets. The effect of the acquisition of these two types of assets on the money supply was partly offset by the rise in "quasi-money" (almost half of which was time and savings deposits in commercial banks), and the rise in government deposits in the bank of Libya, which are not treated as part of the money supply.

Time and savings deposits are excluded from the money supply on the assumption that these are "*idle balances*" and not held as means of payments. It is likely, however, that some part of the demand deposits are held for the same reasons as time and savings deposits and should be excluded from the money supplies, especially when the relation between money and prices is considered.

The rise in claims in the private sector indicates the strong part played by this sector in economic activity, while the increase in government

deposits reflects budget surpluses due to the rapidly rising government revenues in relation to an inflationary effect on prices.

In 1973 foreign exchange reserves fell sharply, while the money supply rose by 25%. The fall in foreign exchange reserves was accompanied by a big drop in government deposits, by budgetary deficit and by large government capital transfers overseas. Even so, the money supply remained more than 100% covered by foreign exchange reserves. In the same year (1973) for the first time the Central Bank included, as cover for part of the currency issue of LD487 million, treasury bills and government securities to a value of LD19 million.

Another factor which may have a bearing on the money supply is hidden in the Figures for "*Other (net)*" liabilities in Table 6.19 below. These had, until 1972, been positive, comprising among other things banks' capital and other liabilities of a long term nature. In 1973 this item turned strongly negative, and continued thus in subsequent years. A negative liability is an asset, but the nature of the net assets of the banking system thus included is not revealed. As they have not been classified as lending to private sector, it seems reasonable to infer that are associated with a public sector borrowing requirement.

In 1974, when the favourable balance of payments on the oil account more than doubled, foreign exchange reserves recovered and exceeded the supply of money by a comfortable margin (see Table 6.19). The position was, however, again reversed in 1975 because of a fall in oil revenues, and a fall in revenue from oil (Libya being a one commodity exporter) resulted in an unfavourable balance of payments and a marked reduction in foreign exchange reserves. In addition to the increase in the stock of money, there was marked increase from 1973 in the velocity of money circulation, which increased from 0.7 in 1971 to 1.3 in 1973 and 1.4 in 1975 [Central

Table 6.19

Money Supply Determinants in Libya (LDM) 1965-1978

End of year	1965	1972	1973	1974	1975	1978
Assets of Banking system:						
1.Foreign Assets	87.11	966.32	668.80	1167.08	690.07	1295.75
2.Claims on the Private Sector	35.20	151.09	240.22	448.35	641.56	950.40
Total	122.31	1117.41	909.02	1615.42	1331.63	2246.15
Liabilities to Banking system:						
1.Money	66.78	392.74	490.97	753.83	844.45	1687.81
2.Quasi-money	28.72	174.67	296.84	579.25	490.66	682.63
3.Governm.deposits	15.82	531.12	355.71	403.58	336.09	464.84
4.Other (net)	10.96	18.88	-234.50	-121.24	-339.57	-589.13
Total	122.31	1117.41	909.02	1615.42	1331.63	2246.15
Velocity of money	1.8	0.8	1.3	0.8	1.4	1.1
Consumer price index (1964=100)	108.3	152.1	170.4	178.5	197.0	297.2
Retail price index for food in Tripoli	157	219	200	215	259	325

Source: Central Bank of Libya, *Economic Bulletins* Oct./Dec [1979] Tables 14, 15, 22, 23 and July/Dec. [1974], p.37.

Bank of Libya, Economic Bulletin Oct/Dec.1979]. The great increases in the bank advances in and after 1973, which include loans to semi-government institutions, reflect the greater needs of the State oil sector for bank credit, as much of the oil industry became nationalised and a larger proportion of the industry's operations was financed in Libya.

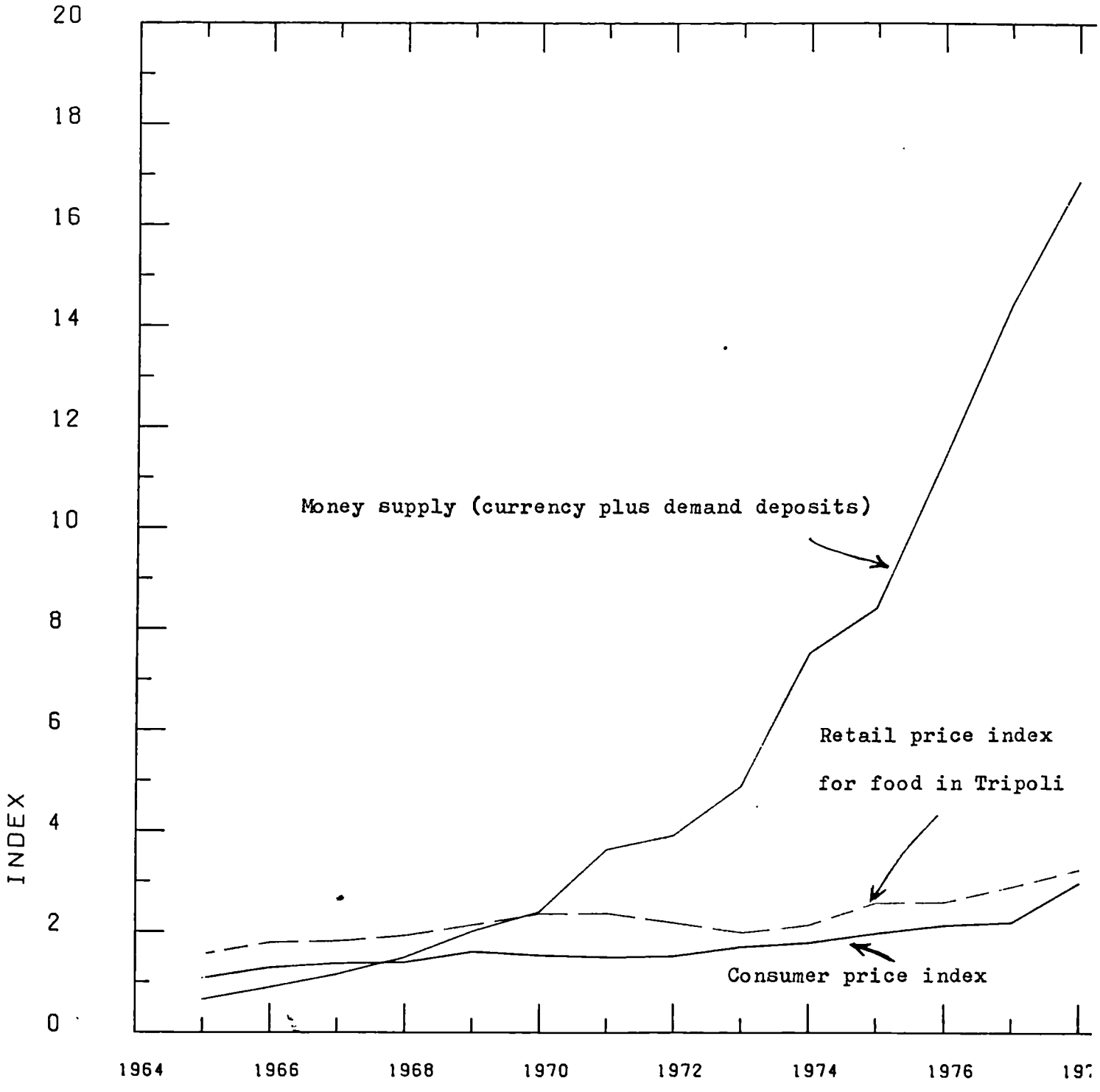
Table 6.19 above and Figure 6.13 below show the rise in the index of consumer prices and foodstuffs in relation to the money supply. It can be seen that prices rose steadily, but not nearly as fast as the money supply. It rose, throughout the post-revolutionary period, at an average of 5.5% a year. The largest increases were in 1973 (12%) and in 1975 (10.4%), when the balance of payments was unfavourable. Throughout this period the plentiful exchange earnings allowed expansionary monetary policies to be pursued without excessive inflationary effects.

The effect of the increases in the supply of money on prices will depend very much on the supplies of goods coming on the market for people to spend their money on, and of these goods, imports supply a large proportion in Libya. Imports, as I noted earlier, more than doubled between 1964 and 1968, when the terms of trade were more favourable, but since the money supply more than tripled there was bound to be some pressure on prices in the absence of a large increase in the domestic production of goods for the domestic market. The supply capacity of the Libyan agricultural sector could not keep pace with the increasing demand that resulted from higher incomes and increased population, as I showed earlier. The limited supply capacity of the domestic economy to satisfy the high levels of demand led the government to abolish most tariffs on food imports in order to fight inflation.

The steep rise in imports up to 1974 are reflected in the increases in quasi-money, much of which corresponded to the margins (usually 100%)

FIGURE 6.13

Indexes of money supply and prices in Libya 1965-78



XAXIS:SCALE AS PRINTED.

YAXIS:SCALE = Y * (10 **-2)

deposits for letters of credit, which thus took the money involved out of circulation.

Throughout the 1960s and the 1970s rates of interest were stable, as would be expected in a Muslim country. The central bank's rediscount rate was 5% and the rate for second loans and overdrafts was 7%.

As I discussed in Chapter 5, the majority of the population still prefers to hold cash to settle transactions rather than use the banking system, and this is reflected in the money supply figures. In April 1980 the government increased interest rates on savings accounts from 4% to 5%, on short-term deposits from 5% to 5.5%, and on medium-term deposits from 6% to 9% in an effort to increase the value of quasi-money in relation to total money supply, which in 1979 made up just under 30% of the total.

These and other operations had to be carried out by only six commercial banking organisations throughout the country. These are all under Libyan control, following banking legislation passed in 1969, which required 51% Libyan ownership of the banks' capital and the chairman and majority of directors of each bank to be Libyan nationals. The Central Bank of Libya exercises strong control over banking activities and has done so since legislation passed in 1971. The banking sector is still, however, very small owing to the high proportion of cash transations.

Future economic prospect:

It is important to mention that forecasts for the oil industry made for the 1970s and early 1980s have proved to be highly erroneous. Table 6.20 presents three forecasts for Libyan production and exports of crude oil during the decade 1980-1990. All three sources suggest production and export levels below those used in preparation of the Prospective Plan.

Discrepancies between the forecasts for exports can be explained by the exclusion from the Speerplan-Finnmap projections of all product exports,

while projections I and II in Table 6.20 are inclusive of exports of products. NLOC assumed steady levels of output of crude oil through to the year 2000 on the basis of indicated or desired production ceilings.

Table 6.20

Forecasts of Crude Oil Production and Exports in Libya (000 b/d)

		1985	1990
Production	1	1,500	1,500
	11	1,600	1,200
	111	1,000	1,000-750
Exports	1	1,380	1,340
	11	1,430	890
	111	520	250-350

Source: I. LNOC [Middle East Economic Survey Sep.1981].

II. Fesharaki:[1981]

III. Speerplan-Finnmap: [1981]

In fact, production ceilings imposed by the Libyan government became less relevant from 1980 as the balance between oil demand and supply in the international market increasingly favoured the consumer. The demand fell while the non-OPEC supply increased, pushing the price downwards. I discussed oil supply-demand balances and imbalances and the role of world oil producers in market stability in Chapter 3. LNOC, however, like many other national oil companies in other producing countries, had difficulties disposing of its crude oil during 1981, and output fell below one million b/d by the middle of the year to levels not experienced on a consistent basis since 1963. Difficulties in selling Libyan crudes at prices acceptable to the national oil company and the government during 1980 and 1981, served to undermine previous possibly over-ambitious plans for Libyan crude oil output rising to 2.5 mb/d in the period 1980-1990. The terms of

trade seemed to be not in favour of Libya by this time, thus some steps have to be taken such as a reduction in the imports of foreign goods and services. Constraints on oil exports, while creating the need for some financial adjustments in October 1981, did have the virtue of enforcing conservation of Libyan oil reserves.

The economic implications of a much reduced potential for crude oil exports could be serious. A marked decline in the government's access to oil revenues would diminish its abilities to fund growth within the domestic economy and limit its use of foreign exchange to finance imports of goods and services. The problem would be mitigated or worsened by the degree of success or failure in commercial exports of the refineries and petrochemical plants that will in future consume so large a proportion of the country's oil output.

Thus, the emergence of the oil booming sector in the late 1950s and early 1960s has changed the Libyan economy from a state of deficit and stagnation to a state of capital-surplus and rapid economic growth. The spending effect analysis of the oil revenues pointed out some significant remarks concerning this economy:

(1) The rapidly growing oil revenues, especially since the early 1970s in the hands of the Libyan government, have enabled the Libyan public sector to invest relatively large amounts in both directly productive activities (agriculture and industry) and social overhead capital (education, roads, health facilities and the like).

. The irregular rainfall and the over exploitation of the underground water in the Northern agricultural areas, has actually begun to slow down agricultural progress, despite heavy spending. Industry too has been facing some real problems, such as shortage of skilled labour and management, the need for raw material imports, and above all competition

from foreign goods.

(2) The major general constraint facing the Libyan public sector spending on development programmes has been the limitation on co-operant (complementary) factors such as skilled labour, entrepreneurs, administrators, professionals, and fertile land. The inadequate supply of such co-operant factors has limited the absorptive capacity of the Libyan economy to utilize efficiently the growing capital funds.

(3) Capital is a necessary but not sufficient condition to achieve and to sustain economic development. Other factors of production such as human resources, natural resources, and technological progress are as important and as effective in the process of development. Furthermore, institutions and attitudes that are favourable to modernization are important ingredients toward achieving and sustaining economic and social development.

However, Libyan economic achievements, even though faced with some real problems such as the inadequate supply of co-operant factors, were no doubt remarkable. The main reason for such success, I think, is very much attached to Libyan handling of the development of its oil industry. The Government's bargaining with the international oil companies working in Libya, in the early 1970s, and the ability of this Government to enlarge such a domestic event to involve other oil producing countries in the world, is the secret behind Libyan economic and political achievements. This topic will be discussed in the next chapter.

CHAPTER 7: OIL COMPANIES' BARGAINING WITH LIBYA AND OPEC

The decade of the 1970s has seen a significant change in the history of the world petroleum industry, and in the economic power of the oil exporting nations. The price of oil at the end of the decade was over five times higher than it was at the beginning in real terms, with profound economic, political, and social consequences for producing and consuming countries.

Apart from the Arab-Israeli War of 1973 and the Iranian crises of 1979, the rise in oil prices and OPEC success was closely attached to Libyan oil policy since September 1969. The conflict between the Libyan Government and the oil companies was essentially a bargaining situation. The ability of Libya to gain its ends depended, to an important degree, on the choices and decisions taken by the oil companies. Libya, as I argued in the previous chapter, had been helped by the fact that it had very little domestic capacity to absorb oil revenues, because of the backwardness of its economy. In fact, Libya tended to accumulate huge foreign exchange reserves, which could easily meet the short or medium run public spending. This increase in income coincided with the change in the Libyan regime, from a traditional pro-Western monarchy to an anti-Western revolutionary regime. The latter had successfully persuaded a third party (the Libyan people) fully to support the leader of the revolution against the interests of the oil companies. The oil industry, which used to be under the complete control of foreign companies, has had a priority in the new regime's political and economic policies. At one stage in Libyan negotiations with the oil companies, Deputy Prime Minister Jalloud stated that Libyan demands were intended to "*hurt the (U.S) companies and force them to put pressure on the United States to change its pro-Israeli policy*"

[Al-Sowayegh 1984 p.110]. To the Libyan revolution, the demand for higher oil prices and the nationalisation of oil companies was of no less importance than the evacuation of foreign armed forces (British and Americans) from the country. These two reasons, from the point of view of this thesis, are the main factors which enabled Libya not only to stand firm in its negotiations with the oil companies, but also to spread the word to other OPEC members, which were not slow to join in taking action against oil companies.

Libyan conflict with the oil companies coincidentally happened at the time when some international problems were causing difficulties for the oil industry. The following events, even though they were not part of the conflict, assisted the Libyan position indirectly:

(1) The 1967 Arab-Israeli War caused the closure of the Suez Canal and the periodic interruption of the "Tapline", the pipeline that carries oil from Saudi Arabia to the Mediterranean. This substantially raised freight rates, which comprised a large proportion of oil prices.

(2) The Biafra War stopped oil production in Nigeria.

(3) In addition to the proximity of Libya to Europe, the growing influence of environmentalists in these countries made the low-sulphur Libyan crude more desirable in comparison with other crudes. Western European imports of Libyan crude reached 30% of their total crude oil imports by 1969.

(4) A large quantity of Libyan oil was processed by small "independents", which had no alternative sources of supply with which to honour their contracts and to keep their refineries in operation.

Before the Libyan revolution a single, closely interlocking set of companies had dealt with a divided group of countries. OPEC tried to redress this disparity by overcoming the division among the countries.

Libyan policy reversed the former situation fully, by dividing the companies and thus allowing a single government to rule them. As just mentioned, for many of the Independents or newcomers among the oil companies, Libya was their only source of crude. Hence, unlike the majors, they were not inclined in any dispute with the government to face the threat of a shutdown. This fact was the key to Libyan success, as will be argued below.

This thesis has as its running theme the notion of a multiple game. For instance I discussed in Chapter 3 the game between various OPEC members and the game between OPEC as one player and other oil producers as the other player. In this chapter I intend to add another game. This game is concerned with a group of international oil companies in a medium range producing country. It is the game between what is called the "*Libyan producers*", which is a group of international Major and Independent oil companies, on one side, and the Libyan Government on the other. It will be shown that Libyan success, to a great extent, has in fact resulted from the outcome of another game between the companies themselves. The companies followed their individual interests and refused to sacrifice to help the troubled member. As will be shown in the case of Occidental, this resulted in a non-cooperative solution, which Libya fully exploited to its advantage. The lack of coordination and cooperation between the foreign oil companies working in Libya, "*Libyan producers*", to overcome the situation had resulted from the Libyan first move against Occidental. This had encouraged the Libyan Government to generalize the terms of Occidental's agreement to the rest of the companies, and thus control them. The non-cooperation between companies, in addition to Libyan power (discussed in the previous chapter), had actually ended the game as a complete success for the Libyan Government, and the effect of this victory

spread to oil producers all over the world.

One would expect that the producing countries' first successful attempt towards output restriction and facing up to the oil companies would be made in Saudi Arabia, or Iran, or Iraq, or Venezuela, or even Kuwait, the established leaders of the founding members of OPEC, rather than in Libya the newcomer to the oil industry. But for the reasons mentioned above, the successful break-through had actually been made in Libya.

The game Libya played against the oil companies was in the form of a repeated two-person game. First against the Occidental Company, then against the Majors and finally against the rest of the Independents. The objective of the game changed over time. While at the beginning the price of oil was the centre of negotiations, later it appeared to be price differentials which were the concern of the Libyan Government. At the time of participation and nationalisation arrangements the objective of the game was neither oil prices nor price differentials, it was the management of the industry itself and the sale of the buy-back of Libyan oil.

In this chapter I will analyse the Libyan Government's tactics in negotiations with the oil companies, and the impact these have had on both the major and the independent companies. I also consider the point at which OPEC took over from Libya in this conflict, and the implications its actions had on the government backed foreign oil companies. But first I will discuss the Libyan oil prices and the efforts of the Libyan National Oil Corporation (LINOCO) to manage the increased responsibilities of the oil sector of which participation, nationalisation, partnership-ventures and marketing of royalty oil, as well as domestic refining of crude oil, are the dominant activities of its function.

7.1 Libyan oil price:

The first sign of Libyan concern about the Government oil income and the price of oil, was apparent from the beginning of oil exports in the early 1960s. This was first signified by the 1961 amendment of the Petroleum Law, which was accepted by the operating companies. The amendment that they state a posted price in their fiscal accounts. The price posted by Esso in 1961 was $2.21 a barrel for 39o API gravity oil, with a drop of 2 cents a barrel for each degree of gravity less than 39o, but a ceiling price of $2.23 for 40o gravity and above [Wright 1981]. Of the other producing companies only Marathon had posted, at the same level as Esso. The calculations by which Esso arrived at its posting ($2.21 a barrel) prices is shown in Table 7.1.

Table 7.1

Libya's First Posting Prices In (US$/b):1961

Posting	Saudi Arabia(34o)		Iran(34o)	Iraq(36)
	Ras Tanura	Sidan	Kharg Island	Banias
Posted Price f.o.b.	1.80	2.17	1.73	2.21
Freight to Rotterdam	0.58	0.26	0.69	0.26
C.i.f. Rotterdam	2.38	2.43	2.42	2.47
Less:				
Freight Brega/Rotter.	0.22	0.22	0.22	0.22
Oil value at Brega	2.16	2.21	2.20	2.25
Average Brega Price	2.16+2.21+2.20+2.25/4 =$2.205 or$2.21			

Source: *Middle East Economic Survey*, 9 and 16 Aug. [1968].

The company rounded up $2.205 to $2.21 and choose 39o as the gravity of Libyan oil commercially equivalent to the four oils used in the calculation [MEES 1968]. The other producers followed Esso's posting in their financial statements to the Government by published postings of their own.

The companies then, as I argued in Chapter 5, proceeded in their accounts to deduct from the posted price, published or deemed, the marketing expenses as defined by the 1961 amendment of the Petroleum Law, including rebates, in order to reach a figure for their income resulting from operations in Libya. After deduction of allowed costs and expenses, this income was taxed at the rate of 50%. Table 7.2 gives the average per barrel prices declared by the Libyan producers during 1961-1964.

Table 7.2

Fiscal Price per barrel($) Declared by Libyan Oil Producers:1961-64

Company	1961	1962	1963	1964
Esso Standard	2.19	2.19	2.20	2.17
Marathon	-	1.64	1.62	1.59
Continental	-	1.71	1.50	1.64
Amerada	-	1.46	1.53	1.61
Esso Sirte*	-	-	2.17	1.96
Mobil, Gelsenberg	-	-	1.89	1.89

(*) Liamco and Grace, sold their oil to their partner Esso Sirte at this period.

Source: Waddams [1980], p.119.

The posted prices by oil companies was the natural start of the Libyan Government's comparison of its oil with other Middle Eastern oils. The location of Libya on the Mediterranean, near to European markets gave it the advantage of what become known as a "*short-haul oil*". In addition, crude oil is a composite commodity, and different crudes yield different product quality according to the content of each crude of some specific chemical elements. The most important elements for the purpose of manufacturing are API gravity and sulphur content. The higher the gravity and the lower the sulphur content, the better the crude and *vice versa.*

Table 7.3 shows a comparison between some of the Middle Eastern crude oil.

Table 7.3

Middle Eastern Crude Oil Data

Country	Crude Name	Crude Gravity (API)	Sulphur Content %WT
Libya	Brega	40.4	0.21
	Bu-Attifel	41.0	0.04
S.Arabia	Arabian Light	33.4	1.76
	Arabian Medium	30.4	2.43
Iran	Cyrus	18.8	3.46
	Dartus	33.8	2.54
Iraq	Basarah Light	34.0	1.95
	Basarah Medium	30.1	3.15
U.A.E.	Murban	39.4	0.74
	Umm Shaif	37.0	1.38
Qatar	Qatar Export	41.4	1.10
	Qatar Marine	37.0	1.50
Kuwait	Kuwait Export	31.1	2.51

Source: Jenkins [1984], Table 97, 115-116.

From the Table above, it can be seen clearly that Libyan crude enjoys three advantages over the Gulf oil:

(1) Low sulphur content.

(2) High degree of API [American Petroleum Institute Specifications] gravity (which means higher yields of the valuable light products).

(3) Proximity to European markets.

These advantages carry premia over the price of marker crude (Arabian Light 34o) which serves as a reference to other crudes. On the other hand, these advantages encouraged Libya to start negotiations with oil companies

in order to increase the price of Libyan crude to match other crudes and to gain further adjustments for its advantages mentioned above. Such claims can be formalized an a game between the Libyan Government as one player and oil companies as the other player, as will be argued later in this chapter.

7.2 The organization of the national oil industry:

Unlike the days of Mosaddeq in the early 1950s, when nationalisation of foreign oil companies was seen to be a crime against Western oil companies, nationalisation in the 1970s, especially after the OPEC rise, has become the norm and a necessary step to be taken by sovereign countries.

As a result of the successful confrontation with the oil companies, Libya, and in this matter other OPEC countries, had increased their foreign exchange reserves substantially prior to the October War and the Arab embargoes. For example, Libyan foreign exchange reserves increased from $m1,499 in 1970 to $m2,925 in 1973. Saudi Arabian foreign exchange reserves increased from $m520 in 1970 to $m3,707 in 1973. This is shown in Table 7.4.

Table 7.4

Foreign Exchange Reserves($m),And Crude Production(mb/d)

In Selected OPEC Countries:1970-73

	1970		1971		1972		1973	
Country	F.Ex.	Pro.	F.Ex.	Pro	F.Ex.	Pro.	F.Ex.	Pro.
Libya	1,499	3.32	2,566	2.76	2,826	2.24	2,925	2.17
S.Arabia	520	3.80	1,291	4.77	2,347	6.02	3,707	7.60
Iran	76	3.83	478	4.54	760	5.02	976	5.86
Kuwait	96	2.94	171	2.20	247	3.28	357	3.02
Iraq	319	1.55	432	1.69	582	1.47	1,323	2.02
Algeria	101	1.03	233	0.79	204	1.06	823	1.10

Source: *International Financial Statistics (IFS)*, 29, [1976], and

OPEC Annual Statistical Bulletin (OASB), [1982], p.13.

Unlike some members of OPEC, such as Saudi Arabia, Kuwait or Iran, Libya had not only increased its posted prices and foreign exchange reserves, but at the same time had reduced crude production and exports in order to force the oil companies to adhere to the Government demands. Its production as shown in the Table above had been reduced from 3.32 mb/d in 1970 to 2.76 mb/d in 1971 and 2.17 mb/d in 1973.

OPEC members had for some time in the 1960s been trying to reach a unified approach to participation in the ownership of the oil companies working in their territory. As I discussed in Chapter 4, OPEC resolution No.XVI.90 of 25 June 1968 declared that governments of member countries may acquire a reasonable participation. This had been made possible by the break through of 1970-71 started by Libya, and the availability of foreign reserves to pay for the participation in or nationalisation of oil companies.

For Libya to manage the growing activities of the oil sector, it had to establish a new and qualified management. Some personnel had to be borrowed from other sectors of the economy. The Libyan National Oil Corporation was established in March 1970 replacing the old Lipetco, to take resposibility over the oil and gas resources, from exploration to final manufactured products as well as participation and joint-agreements ventures. This topic will be discussed below.

7.2.1 Libyan National Oil Corporation (LINOCO):

After independence in 1951 Libya was divided into 10 provinces; in order to adapt the Petroleum Law of 1955 to all of them, each province was represented by one member in the Petroleum Commission under a federal chairman. The terms of that law have been discussed in Chapter 5. The Commission was to be responsible for the implementation of the provisions

of the Law under the supervision of the federal Minister responsible, at that time the Minister of National Economy. When the time for petroleum production approached, the increasing complexity of the problems and administration of the industry showed the Commission to be quite inadequate for its task. A Ministry of Petroleum Affairs was created in 1960. Under Law No. 6 of 1963, the Commission was abolished and all its powers and responsibilities transferred to the Ministry of Petroleum Affairs. The Ministry's activities involved the management and exploration of oil resources in its various phases, the distribution of locally manufactured and imported petroleum products, participation with oil companies, and the determination and safeguarding of price levels. The Libyan General Petroleum Corporation (Lipetco) was created by Law No. 15 of 1968, to be responsible for executing these activities. During the first year of Lipetco's life its major activity was concerned with joint ventures. The first joint-venture agreement was made in the spring of 1968 with the French State-owned Erap/Aquitaine group. The agreement stipulated that the French partner would undertake exploration with very substantial minimum working obligations ($22.5 million expenditure in 10 years) [MEES, 19 April 1968]. Lipetco's share was to be 25% of production up to 200,000b/d, increasing by steps until it reached 50% at a production level of 550,000b/d. Lipetco was to finance the development costs of its share, but the French companies would procure finance for Lipetco at favourable interest rates. There was also to be a progressive royalty payment, beginning at 12.5% and rising to 15% when production reached half a million barrels per day. The bonus payable was $1 million on signature, $3 million on commercial discovery and $9 million when production reached 300,000b/d.

Four other joint-ventures were embarked upon in the summer of 1969 with Shell, Agip, Ashland Oil and Refining Co. and Chappaqua Oil Corporation.

Because of the lack of experienced personnel at first, the joint-venture agreements which were made in the spring of 1968 with the French companies were negotiated in the Ministry, under the supervision of the Minister, and handed over to Lipetco only at signature [Wright 1981 p.233].

After two years, on 5 March 1970, the revolutionary government replaced Lipetco with a new National Oil Corporation (Linoco). Its prerogatives, fields of activity and duties were similar to those of Lipetco. It continued to be an independent body, operating under the supervision and control of the Minister of Petroleum in order to achieve the development plan objectives in the oil sector. The new Law No. 24 of March 1970, limited any new joint ventures to those in which the foreign partner took the whole of the risks in the pre-commercial exploration period, and insisted on Linoco's share being fixed at a given percentage from the start of operations, and not on a sliding scale as in previous joint ventures. This new corporation had various activities; for convenience I split these activities under two headings, corresponding to upstream operations and downstream operations. These are; (A) drilling and production and, (B) domestic refining.

A- Drilling and production:

Linoco acquired most of the relinquished areas and surrendered concessions. The land under direct exploration by Linoco was recorded as 234,000 square Kilometres. Early in 1972 a joint drilling venture was established between Linoco and ENI by which the latter's subsidiary, Saipem, was to operate 18 drilling rigs in Libya for Linoco, 12 of which were for exploration. In 1974 the number was increased by the 3 rigs of the Oasis companies and from then onwards more rigs were added as a result of the new production sharing deals. There was some real increase in Linoco's exploration, as well as drilling as indicated in Table 7.5. In

the 1970s many oil fields were developed, the most important, of which Agip's Bu Attifel field in Concession 100, promised to be a major operation of 300,000 b/d production.

Table 7.5

Linoco's Oil Activities: 1977-1980

Year	No.of oil wells	Linoco's prod.(000b/d)	Other prod.(000b/d)	Total
1977	1827	1,369	693	2,063
1978	1935	1,302	681	1,983
1979	2093	1,412	680	2,092
1980	2218	1,232	589	1,830

Source: *Central Bank of Libya, 25 Annual Report,* [1980], p.86. And *OPEC Annual Statistical Bulletin,* [1982], p.81.

After 50% Government participation in October 1972, production began and reached 110,000 b/d in 1973, rising to 156,000 b/d in 1976. Linoco's production averaged 300,000 b/d during 1973-1976, and counted for 65.66% of the total production in 1978 [Central Bank of Libya 1979]. Its exports fell from 45.5% of total exports in 1979 to 45.3% in 1980 [Central Bank of Libya 1980]. Linoco's first group of sale contracts of royalty oil abroad was made between September 1970 and March 1971 as shown in Table 7.6.

Table 7.6

Linoco's Sale Contracts Of Crude Oil(000 tons): 1970-1971

Date of contract	Buyer	Quantity contracted	Q.delivered
Sep.1970	OMV[Austrian]	300	304
Oct.1970	Witco[Austrian]	4,700	118
Oct.1970	Egyptian Pet.Co.	750	467
Dec.1970	Perola S.A.[Swiss]	2,250	100
Mar.1971	Naphthachem[Bulgarian]	1,000	493

Source: Ministry of Petroleum, *Libyan Oil, 1954-1971*, [1972], p.116.

The quantities involved amounted to 9 million tons, of which 1.5 million tons was delivered by the end of 1971. These sales were made in times of great uncertainty about the future course of prices, and the prices stated, at or above the posted prices of oil at the times of sales, were agreed in principle. In April 1974 Linoco was selling direct to customers 70% of its settlement. There were barter deals, one with France in March 1974 of 7 million tons a year, another with Argentina in November 1974 of 50,000 b/d in exchange for food and, there are still some barter deals operating.

In the 1966 concessions most applicants had offered, as an extra benefit, priority to Libyan tankers, provided their terms of charter were on a par with other available tankers. Libya thus had a ready-made potential for tanker usage, and from 1971 onwards Linoco began ordering vessels. Orders for two vessels of 47,000 tons each from Spain (for the Zawia refinery) as part of a barter deal for oil, and two of 86,000 tons from Japan, at a cost of $14 million each, were reported in 1972, and two further tankers of over 100,000 tons were ordered in 1973. These orders were fulfilled in 1975, and in 1975, and in 1976 plans were announced to increase the fleet by 50% to 12 vessels of a total tonnage of 686,500 tons. By 1980 15 oil and products tankers were being operated by the state Libyan General Maritime

Transport Organization (LGMTO).

B-Domestic refining:

The first purpose of a local refinery was to meet the country's own rapidly increasing demand for the main oil products that had previously been imported. Domestic oil consumption increased from 16,000 b/d in 1970 to 48,000 b/d in 1975 and 120,000 b/d in 1980, (giving the highest consumption per capita in Africa), with a projected total of 215,000 b/d in 1985 [OAPEC Bulletin Jan.1980]. The consumption of refined products in Libya have risen from 63,000 b/d in 1977 to 80,300 b/d in 1979 and 109,700 b/d in 1981. The rapid increase in domestic refined products has affected the exports of these goods, which declined from 99,200 b/d in 1978 to 84,600 b/d in 1979 and 72,500 b/d in 1980, as shown in Table 7.7.

Table 7.7

Domestic Consumption and Exports of Refined Products in Libya(000b/d)

1977-1980

Year	Domestic consumption	Exports	Total
1977	63.0	91.2	154.2
1978	69.8	99.2	169.0
1979	80.3	84.6	164.9
1980	89.3	72.5	161.8

Source: *OPEC Annual Statistical Bulletin*, [1982], 96-127.

Esso's original 10,000 b/d refinery, opened at Mersa Brega in 1967, was never able to meet all domestic demand. A refinery at Zawia (40 km. west of Tripoli), of 60,000 b/d, built by an Italian firm called Snam Progetti at a cost of 25 million, was completed and commissioned in 1974 [Central Bank of Libya 1977]. Thereafter a doubling of its capacity was completed in June 1977. Zawia was also well placed to be the main outlet for the long-projected "Western pipeline", designed to gather in the production of

production of the small and scattered strikes made in various parts of western Libya since the 1950s, but not considered individually commercial because of their size and remoteness. Linoco's plans for an 18-inch, 400 km. pipeline to deliver an initial 50,000 b/d of this western country crude to Zawia (rising eventually to 150,000 b/d) were finally approved in 1977 and a consultancy contract was awarded in 1980 [Mansfield 1981 p.31]. In 1971 Linoco arranged a processing deal with Sincat in Italy for refining oil products for Libyan consumption. Concessionaires were obliged by the Petroleum Law to supply crude oil at field storage price for a refinery in Libya producing for Libyan consumption. By July 1971 the companies supplied 70% at cost and 30% from royalty oil. Thus the Government achieved a cheap supply of oil for internal Libyan consumption. This was made even less costly when Linoco acquired its own crude oil supplies and when the Zawia refinery came on stream in 1974.

In its 1966 concessions Occidental had offered, in addition to the development of Kufra as described earlier, to construct and pay for 50% of an ammonia plant, the Ministry was to pay the other 50%, to provide fertilisers for Libyan agriculture and for export. It was to have an initial production capacity of 600 tons a day, capable of expansion to 1,200 tons a day, and to use gas supplied by the Libyan Government. The company thereupon requested to switch to a methanol plant on similar terms, and this was agreed by the Government after the Revolution in 1969. In 1972 the National Methanol Company was created to implement the agreement with Occidental. The plant was to have a capacity of 1,000 tons a day of methanol, but it was not until 1974 that a contract for construction was entered into, the cost involved being $88m [OAPEC 1976 p.213]. Occidental, as part of its production-sharing agreement of 1974, was relieved of further financial obligations at a time when the costs had amounted to 15%.

A complex was first planned near Benghazi, to which Agip had offered to construct a gas-line as its joint-venture deal. The site was subsequently changed to Mersa Brega where royalty gas would be readily available, and British firms, which included Power Gas Company and ICI, were retained by Linoco as consultants. A plan to construct an ethylene plant to produce 300,000 tons a year at a cost of LD60 million (Libyan Dinars) was announced in June 1975. Libyan petro-chemical production rose from 305,000 tons in 1978 to 500,000 tons in 1979 [Central Bank of Libya 1979 p.43]. It was not until mid-1980 that the Government took a 51% share in Esso's technically complex and troublesome natural gas liquefaction plant at Mersa Brega, mainly because of lack of local technical expertise.

7.2.2 Participation/nationalisation movement:

Participation refers to negotiated joint ventures, production-sharing, service contracts and other forms of co-operation between government and company. Nationalisation is taken to mean compulsory acquisition of part or all of an oil company's business by the government. The distinction is blurred when government participation is forced on a company under pressure, and the company acquiesces either at the time or subsequently. These cases will be classified here as nationalisation.

In its Resolution No.XVI.90 of 25 June 1968, OPEC, as I mentioned before, declared that governments may acquire a reasonable participation on the grounds of changing circumstances. In June 1971 OPEC set up a Ministerial Committee to draw up the basis for the implementation of effective participation by member countries. The Committee recommended that participation should be implemented, without committing itself to a precise percentage figure, that compensation should be at net book value, and the companies should be obliged to buy back participation oil to the extent required by governments. Thereafter Libya, together with Nigeria,

announced that they intended to pursue negotiations for participation with their concessionaires on an individual basis [MEES, 10 March 1972].

The first Libyan agreement on participation in an existing concession was with the Italian company ENI, and its subsidiary Agip. Agip had developed the Bu Attifel field in Concession No.100, with an ultimate potential of some 300,000 b/d, but it hindered in by a Ministry order which insisted on satisfactory utilisation of associated gas. In September 1972, after two years of desultory negotiations, ENI proposed 50 percent state participation to combine with its already existing joint venture, where there had been 43 wells drilled resulting in 8 non-commercial discoveries. The terms were that the Government would pay in cash 50% of approved expenditure already incurred in Concession 100 [PIW, 9 Oct.1972 and 5 March 1973]. This was agreed at $62.4 million to be paid over 5 years. The output target for Bu Attifel for 1973 was put at 200,000 b/d. There was to be a management committee of 3 Italians and 3 Libyans, the Chairman being Libyan and the Managing Director Italian.

BP was nationalised on 7 December 1971, by the decision of the Revolutionary Command Council. This was done in reaction to British failure to act to prevent the Iranian seizure of the Tumb islands in the Arabian Gulf. The decision established the Arab Gulf Exploration Company (INJAZ), a subsidiary of Linoco, to take over the assets and business of BP. The Libyan action presupposed that BP represented the UK Government, which held approximately half of its ordinary shares. BP's personnel were ordered to stay in their posts, and Libyans were drafted in from other companies, which were to continue to pay them. The nationalisation decision included provisions for compensation to be fixed by a 3-man committee set up under the chairmanship of a Counsellor of the Libyan Courts of Appeal, whose decision would be final. BP was prevented from

loading oil at Harega terminal, but N.B.Hunt, its 50% partner (but not operator) in the Sarir field was unaffected. Other oil companies' production was frozen at existing levels so as not to supply BP. In October 1972 N.B.Hunt received a demand from the Government for a half-share of all oil sold since the nationalisation of BP, and a 50% State Participation thereafter. This demand was accompanied by a ban of Hunt's exports, which lasted until January 1973 when liftings were resumed. At the same time it was made clear by the Government that 50% State participation was negotiable, and was a preliminary step to a greater portion being acquired by the State later, and that such participation would apply only to profitable concessions. In June 1973, following Hunt's refusal to accept participation terms and to market Injaz's (previously BP) share of Sarir crude, Hunt's interest was nationalised.

BP, as well as pursuing claims for its oil through the courts whenever it could, also initiated arbitration proceedings against the takeover in the International Court of Justice. However, much of the nationalised oil was sold to Eastern Europe where it was safe from pursuit. For example, Soviet liftings of Sarir crude rose to more than 100,000 b/d [PIW, 31 July 1972]. In November 1974 the Libyan Government reached a full and final settlement with BP, whereby the latter received a net payment of £17.4 millions. This represented £62.4 millions compensation for the value of the assets seized, less £45 millions retroactive payments assessed as due from BP according to the terms of the posted price agreement of October 1970. In October 1976 BP stated that its dispute with the Libyan Government was ended, and that it would consider service contracts with the Libyan Government [PIW, 11 Oct.1976].

In September 1975 Hunt came to an agreement with the Libyan Government, and announced that he had no further rights in his concession or the oil

from it.

During the early months of 1973, negotiations with companies took place in which the Libyans proposed 50% take-overs at net book value, and buy-back of Government oil so acquired at a price half-way between posted price and tax-paid cost to the companies. In May the Government requested the companies to make their own proposals along the lines of the service contracts/production-sharing arrangements, similar to the new arrangements in Iran and elsewhere. This was followed by a one-day stoppage of loadings as a protest at the situation in the Middle East. On 11 August the Government decreed a partial nationalisation of Occidental (51%), and the company formally signified its acquiescence. Immediately afterwards Oasis was subjected to similar treatment with 51% nationalisation and compensation at net book value. Continental, Marathon and Amerada, the concession-holders which between them owned 83.33 of Oasis, acquiesced, but Shell, which owned the remaining 16.67%, did not. Its liftings of oil were embargoed from 12 August. The Oasis settlement also included a company undertaking to maintain three rigs in operation in Libya, mentioned earlier when I discussed Table 7.5.

After the leading independents, the Government turned to the majors. Amoseas the operating company of Texaco and Socal almost immediately had its allowable production cut by 50% to 100,000 b/d, and at the same time strong pressures were put on all the majors to acquiesce in nationalisation on similar terms. Refusal would be likely to result in total shut-down of their Libyan operations. The general nationalisation decree of 51% of the assets and business of the producing majors came on the fourth anniversary of the revolution, 1 September 1973. It comprised all the producing majors Esso, Texaco and Socal and their partners Liamco (Arco), Grace and Gelsenberg. The nationalisation decrees took 51% of the assets and

business of the companies concerned for the Government, with the exception of Esso's gas liquefaction plant [MEES, 14 Sept.1973]. Compensation was to be decided by a committee of three, headed by a Justice of the Court of Appeal and including Linoco and Treasury representatives. The companies were to continue to operate in the concessions under a management committee of three appointed by the Ministry of Petroleum, two of whom, including the chairman, were to be Libyans, the third the resident manager of the operating company. All employees of the companies, regardless of nationality, were to continue at their posts, and the parties were to make arrangements within a month for the lifting of Linoco's share, including the quantities and prices involved.

The Government decision, which made the non-nationalised companies somehow relaxed, was that in the middle of September Occidental was allowed to increase its production from 360,000 b/d to 475,000 b/d, with a stipulated buy-back price of $4.90 per barrel for its nationalised oil. By the end of September it was reported that Libyan crude was being sold for $5.50 per barrel and there were rumours that Occidental's high-gravity oil was fetching $5.85-$5.90 per barrel. Until February 1974 the majors had been continuing to lift their Libyan oil as fast as they could, and to pay Government dues on the old concession basis. In the middle of February the Libyan government seized the Amoseas operation (Texaco and Socal) and the Liamco (Arco) share of Esso Sirte (25.5%). In March Mobil acquiesced in its 51% nationalisation and at the beginning of April the government seized the Shell 16.7% interest in Oasis, bringing its total interest in this partnership operation to 59.16%. In the middle of the month Esso acquiesced in 51% nationalisation (which excluded the gas plant).

Shell reached an accord with the Government on compensation for nationalisation in June 1974. The agreement provided for payment in oil at

a rate of 40,000 b/d and for liftings by Shell of Linoco's oil at a discounted price. Thereupon Shell dropped all legal complaints against the Government [PIW, 17 June 1974]. Amerada had received $19.4 million compensation, Continental and Marathon $42.5 million each [Central Bank of Libya 1973]. Towards the end of 1977 Texaco and Socal reached a settlement on their nationalisation, which amounted to $76 million payable in oil over 15 months [Petroleum Economist Nov. 1977].

The State's share of total Libyan production in 1975 of 1.5 mb/d and in 1976 of 1.9 mb/d amounted to 64%, excluding royalty oil. During 1978 the situation of the operating companies, concession-holders, and partners was as shown in Table 7.8 below.

New terms for old business:

While the nationalisation battle with the majors was still raging, Occidental signed a production-sharing agreement with Linoco, covering 21 widely spread areas of new land. It was described as a "pace-maker" for several other similar ventures that followed. The principal provisions of the agreement were that Occidental undertook to spend $90 millions on exploration in the new areas and would be entitled to 19% of the oil produced from them, free of Libyan taxes and royalties. Linoco would pay to Occidental its own 81% share of development costs, but would be reimbursed for this at a rate of 5% per annum interest-free after oil exports from the areas allocated reached 100 million barrels. This production-sharing agreement was quickly followed by others, which were agreed in principle in April 1974 and signed in the following October. The agreements so concluded were with Exxon, Mobil (later joined by Gelsenberg), Campagnie Francaise Des Petroles (CFP), Elf-Aquitaine and Agip. In essence they were similar to each other and to the Occidental venture. They all provided for production sharing between the Linoco and

Table 7.8

List of Operators,Concession-Holders,and Their Partners

During 1978 and 1982

Operating company	Concession-holders and partners	%1978	%1982
1.Oasis Oil Company	Amerada	8.20	-
	Marathon	16.30	-
	Continental	16.30	-
	Linoco	59.20	-
2.Occidental Libya	Occidental	49.00	-
	Linoco	51.00	-
3.Mobil Oil	Mobil	31.85	-
	Gelsenberg	17.15	-
	Linoco	51.00	-
4.Agip	Agip	50.00	-
	Linoco	50.00	-
5.Aquitaine	Aquitaine	28.00	-
	Murphy	16.00	-
	Hispanoil	42.00	-
	Elf	14.00	-
6.Esso Standard	Esso Standard	49.00	00
	Linoco	51.00	100.00
7.Esso Sirte	Esso Sirte	24.50	00
	Grace	12.00	-
	Linoco	63.50	88.00
8.Arabian Gulf	INJAZ	100.00	-
9.Amoco	Amoco	100.00	-
10.Wintershall Libya	Wintershall	50.00	-
	Al-Forat Libya	50.00	-
11.Union Rheinische	Union Rheinische AG	100.00	-
12.Om Al-Farood Field	Linoco	100.00	-

(-) No change.

Source: Ministry of Planning, *Annual Report on Libyan Oil Industry,* November [1979], 32,33. And O.A.S.B., [1982], p.79.

the company in the ratio of 85:15 on-shore and 81:19 off-shore [Petroleum Economist, Nov. 1981 p.30]. The company expenditure commitment on exploration was $90 millions over six years for Esso, $70 millions over five years for CFP, $45 millions over four years for Elf-Aquitaine and $82 millions over five years for Agip. Linoco was to provide its share proportion of development costs on-shore and 50% of them for off-shore development. These would be reimbursable to Linoco by the company at a rate of 5% a year, beginning after three years of exports or 80 million barrels.

It is not easy to quantify the expected profitability to the companies of these agreements, made at a time of great disturbance in oil companies' command over their oil resources, of volatility in price levels and uncertainty about the future course. It is, however, clear that to establish title to even 15% of oil reserves established through their exploration commitment, at cost and free of taxes and royalties, would be of substantial benefit. On the Libyan side, the agreements provided a satisfactory answer to the problem of stimulating exploration by the large funds, the high technical skills, and expertise in execution which the oil companies possessed, by giving them strong incentives to achieve success. The large investment required by Linoco in the case of development was by no means beyond the financial capacity of the State, as I stressed at the beginning of the chapter. In addition to the pay-back of these investments from Linoco's share of production, they would be recouped from the oil company partners over 20 years in the case of the establishment of sizeable fields.

7.3 Libya's threat and the oil companies' response:

It is clear from the above discussion that Libyan oil had been underpriced, despite the advantages of being a short-haul oil with low sulphur content and a high API gravity. To correct the course of business the Libyan government had to negotiate with oil companies, either collectively or one by one. This seemed a hard task for the monarchy government before 1969. Even though King Idriss, as I discussed in Chapter 4, demanded a 10 cent rise in the posted price for Libyan oil, he was not able to get what he wanted. Probably because of its close political, military and economic relationships with the West, especially the U.S. and the U.K, the monarchy would not put pressure on oil companies. However, these governments were concerned with the security of the companies, especially those companies which to a great extent were government owned, such as the British Petroleum Company (BP).

The game between Libya and the foreign oil companies had effectively begun after the September Revolution of 1969. The conflict between the Revolutionary Government in Libya and the companies was, in fact, part of the wider anti-Western move against the U.S., the U.K. and other governments. This is evident from the beginning when the Libyan Government immediately started serious negotiations with both the American Government and the British Government to evacuate their military forces from Libya. The opposition to Italian and Jewish settlers was another evidence of Libyan intentions. Thus it is not surprising that the Government would wish to renegotiate the interests of foreign oil companies in Libya.

The problem which affected the companies decisions is that there were other parties interested in the outcome of the game between the companies and Libya, even though these parties were not directly involved in the game. The companies were fully aware that if Libya had any success in

these negotiations the outcome would be multiplied and the effects would be widened to other oil producing countries. This was an important factor in the companies' final decision. The most interested parties in this game were as follows:

(a) Oil companies other than Libyan producers; these were mostly affiliates to the same companies working in Libya. They were likely to be faced with similar demands by their host governments if Libya succeeded in its negotiations with the companies.

(b) OPEC producers; these had been trying for a whole decade (the 1960s) to break through the companies' defences, without visible success. If Libya succeeded no doubt they would follow suit.

The conflict Libya had with the foreign oil companies was essentially a bargaining situation. According to Schelling [1963 p.5], bargaining situations are situations in which the ability of one participant to gain his ends is dependent to an important degree on the choices or decisions that the other participant will take. Meanwhile, participants make their decisions independently, they do not choose a pair of strategies together.

The Libyan Government's general aim was to use the same amount of oil resources to get higher utility. Its payoffs can be distinguished as short-run and long-run targets:

(a) In the short-run the aim was to increase oil revenues with a constant or even reduced rate of depletion. It initially meant to reverse the monarchy's oil policy, that the companies were allowed to produce more oil than they should. This could be done to gain public support. Behind that Libya sought to pursue a new policy, that sovereign nations could increase their oil revenues by selling oil at higher prices as long as there is sufficient demand for it.

(b) In the long-run Libya aimed to maximize the value of oil reserves.

The higher the price of oil the higher the value of the country's reserves.

In the attempt to achieve these aims the Government put forward a list of demands for the companies to study and submit proposals. These demands were:

(a) An increase in posted prices.

(b) A change in the gravity differentials structure.

(c) A rise in the tax rate on profits.

Since oil companies had enjoyed for some time cheap, high quality Libyan oil, they preferred to do so for a longer time if they could. But since the Libyan Government had changed course, they somehow had to deal with the Government's new demands. The possible strategies open to them were as follows:

(a) Accept the Libyan Government's demands.

(b) Refuse the Libyan Government's demands.

(c) Accept some of the items and reject the others.

(d) Increase the posted prices with a reduction in the rate of output.

(e) Slow or freeze new exploration and development programs.

(f) Pull out of the country.

The companies' choice of any of these strategies depended upon the Libyan Government's actions and *vice versa*. The companies needed to form a clear view of the Government's strategies. These are similar to their own strategies. The Libyan Government's possible courses of action were as follows:

(a) Welcome and praise the companies acceptance of its demands.

(b) Reduce the country's crude production.

(c) Re-organize the granting of exploration, concessions and probably invite companies not involved in Libyan crude operations to submit tenders.

(d) Freeze crude oil production.

The employment of a particular strategy by the Government depended solely on the companies' response to its demands, but the companies had a wide range of choice, extending from acceptance of government demands to a pull-out of the country. Their choice would depend, on one hand, on the cost of each strategy; for instance the cost of a pull-out of Libya was certainly higher than the cost of a slow-down in exploration and development programs. On the other hand their choice would depend on the anticipated Libyan Government action.

At the start of negotiations both parties had to search for the "*status quo*" utilities; these are the parties' security levels. Meanwhile, each party disposes of alternative sanctions it may exercise in case of a breakdown of negotiations. Correspondingly each party has a choice of threat, and so the positions in which the two parties would find themselves if there were a breakdown is no longer necessarily the "*status quo ante*". It is now a variable payoff pair, depending on what sanctions will be taken. I will follow the literature and call this pair the "*threat point*".

Libya from its side announced the action it would take in such a case. It made it clear to the other party that it would freeze crude oil production if the oil companies would not agree to its demands. The announcement of this choice constituted a *threat* to the oil companies. The efficacy of such threats depends on the credulity of oil companies that the Libyan Government would carry it out.

As I mentioned above, the Libyan Government's insistence on evacuating foreign military forces from the country and the anti-Western attitude of this Government were actually clear examples of the seriousness and determination of the rulers of Libya to fulfil their ambitions.

Taking this into account, Libya's threat to the oil companies was no doubt credible, especially after Qadhafi's address to oil company

representatives, where he stressed that Libyan people had lived for five thousand years without petroleum were able to live again without it.

Another point of concern which made the Libyan threat to the oil companies credible is that by the time negotiations were in progress, Libya had accumulated enough reserves to keep the country running for more than two years at the spending rate of that time. Total foreign exchange reserves were $2666 million while total expenditure was about $1207 million per annum. This gave foreign exchange reserves equal to 2.2 times total annual government expenditure [Parks 1974 p.232].

Even though the Libyan threat to the oil companies was credible, this in no way determines the outcome of the game. What actually determines the outcome of the game is the reaction of oil companies to the Libyan threat.

The oil companies seemed not to have payed much attention to the Libyan threat; instead they set out to negotiate, and two of them, Occidental and Esso, made some proposals. These were dismissed by a government committee. After six months delay the Government proceeded to take action by employing strategy (b). It ordered the cutbacks on Occidental's production. The latter company turned to Esso, the most important producer, for help. Either the other companies should compensate Occidental for the cut in its production, or it would agree to the Libyan Government's demands.

The companies' negotiations between themselves could be of great benefit to the Libyan Government. There was nothing the Government wanted more at that stage than disagreement between the oil companies. The companies, though, turned to each other in an attempt to re-organize themselves in order collectively to work out a unified plan of action against the Libyan Government.

The oil companies, all of them, realised at this stage that the only strategy, if any, to protect them from the Libyan actions was complete

cooperation and co-ordination between the so-called "*Libyan producers*". Against this background Occidental approached the other oil companies for negotiations. Its aim or payoff was to reduce the scale of the cutback in its production and to prevent further cuts. The other companies' payoff was to prevent a similar treatment of themselves by the Libyan Government. The companies had to set their strategies, which were as follows:

(A) To back Occidental and compensate it for the cutback in its production.

(B) Not to compensate Occidental.

If the companies chose strategy (A), it would mean that Occidental would not accept the Libyan Government's demands unilaterally; it had to act according to the companies collective strategy. This strategy at the minimum would delay the agreement by Occidental, or any other company, to the Libyan demands. Nevertheless the other companies may still have to face Libyan actions if the latter decided to carry on with such a strategy. If this was the case, the other companies would lose more by employing their first strategy. Thus the employment of strategy (A) depended upon how far Occidental was prepared to cooperate with these companies. In other words how much other companies trust Occidental to cooperate with them.

Now suppose the other companies did not trust Occidental and decided not compensate the company (strategy B). In this case there would be no alternative, the companies either voluntarily accept Occidental's agreement with the Libyan Government if the latter (Occidental) agreed to comply with the Government demands, or face similar treatment by means of a cutback in other companies' production.

The other companies' decision is actually dependent upon the strategy that Occidental would employ. These companies, for instance, would not

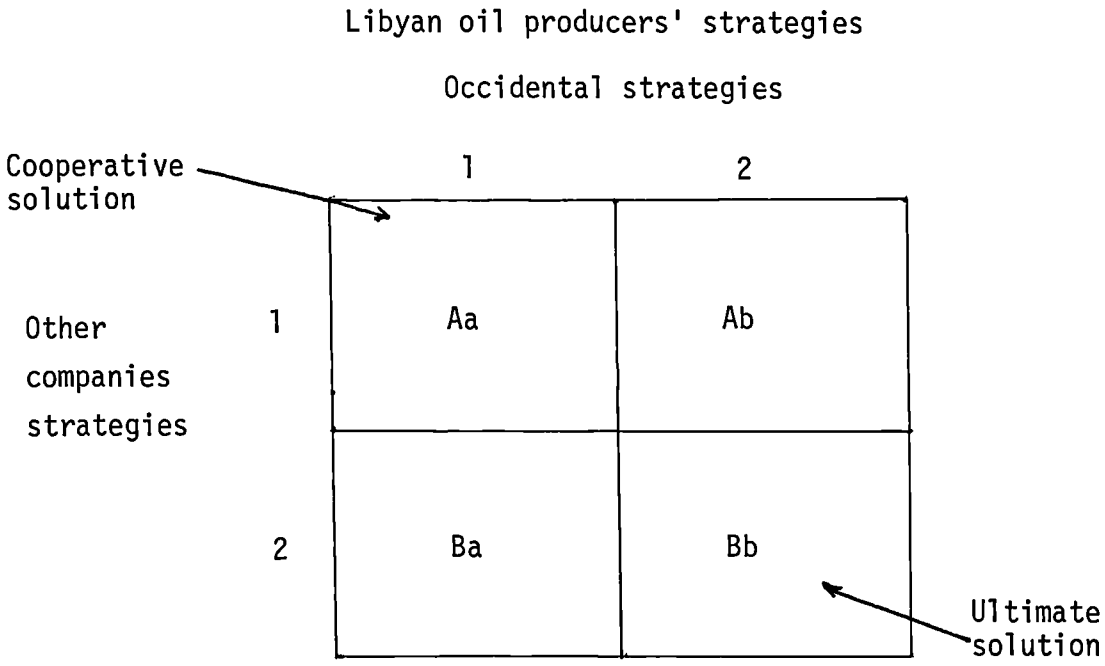
wish to back Occidental if the latter decided to accept the Libyan demands. But as I argued in Chapter Three, mutual dependence is part of the logical structure of the game and demands some kind of collaboration or mutual accommodation, tacit if not explicit, even if only in the avoidance of mutual disaster. But conversely, mistrust between the parties could lead to non-cooperative behaviour.

However, Occidental's strategies seemed to be limited. It had a choice of the following strategies:

(a) To reject the Libyan Government demands and co-ordinate with other oil companies.

(b) To accept the Libyan Government's demands regardless of other companies' strategies.

If Occidental employed its strategy (a), under the condition of other companies employing their first strategy (A), this would mean that the companies (all of them) decided on a cooperative strategy (Aa). Such a choice would have a significant impact, not only because it leads to a cooperative outcome of the game between the oil companies themselves, but also for a possible ultimate gain concerning the original game between Libya and oil companies. But because of mistrust between oil companies this strategy would not be employed. That is because a number of Libyan producers, who happened to be the most important producers of Libyan crude, are Major companies. These had for some time, especially during the 1950s and 1960s, been competitors to the rising Independent companies of which Occidental was one. If the other companies mistrusted Occidental by employing their strategy (B) while Occidental went on rejecting the Libyan demands with strategy (a), the parties would end up with (Ba) as shown in the matrix below.


Libyan oil producers' strategies
Occidental strategies
Cooperative solution
1
2
Other companies strategies
1
2
Aa
Ab
Ba
Bb
Ultimate solution

Such a strategy would not be of great significance to Occidental simply because the company would not be able to stand firm alone against the Libyan Government. And if Libya employed its extreme strategy by freezing Occidental's production that would be less than a third of the country's total production. This would not be as costly for Libya as it would be for Occidental. So the possibility of further cutbacks in Occidental's production by the Libyan Government was still there.

However if Occidental choose strategy (b) by accepting the Libyan Government's demands, there would not be much point in the other companies compensating for Occidental's production cutbacks (Ab). The other companies would have no choice but to prepare themselves either to be faced with similar action from the Libyan Government or to accept the Government conditions and sign an agreement similar to Occidental's. Thus at last the companies had come to end up with a non-cooperative solution by choosing (Bb) (matrix above). The above assessment illustrates the non zero-sum game, which I discussed in Chapter Three in relation to the prisoners' dilemma. The difference between the two cases is that the communication problem facing the prisoners is replaced with a trust problem in the case of the oil companies' game.

To illustrate the above discussion graphically, suppose that Occidental's crude production from Libya is represented by the horizontal axis in the Figure 7.1, while the other companies' production is represented by the vertical axis.

The total companies' production prior to the Government cutbacks of Occidental's production is at point D on the production line AB. Occidental's production is OM and other companies' production is OL. The trouble started when the Government ordered the cutback in Occidental's production in May 1970. This action is represented in the Figure as a

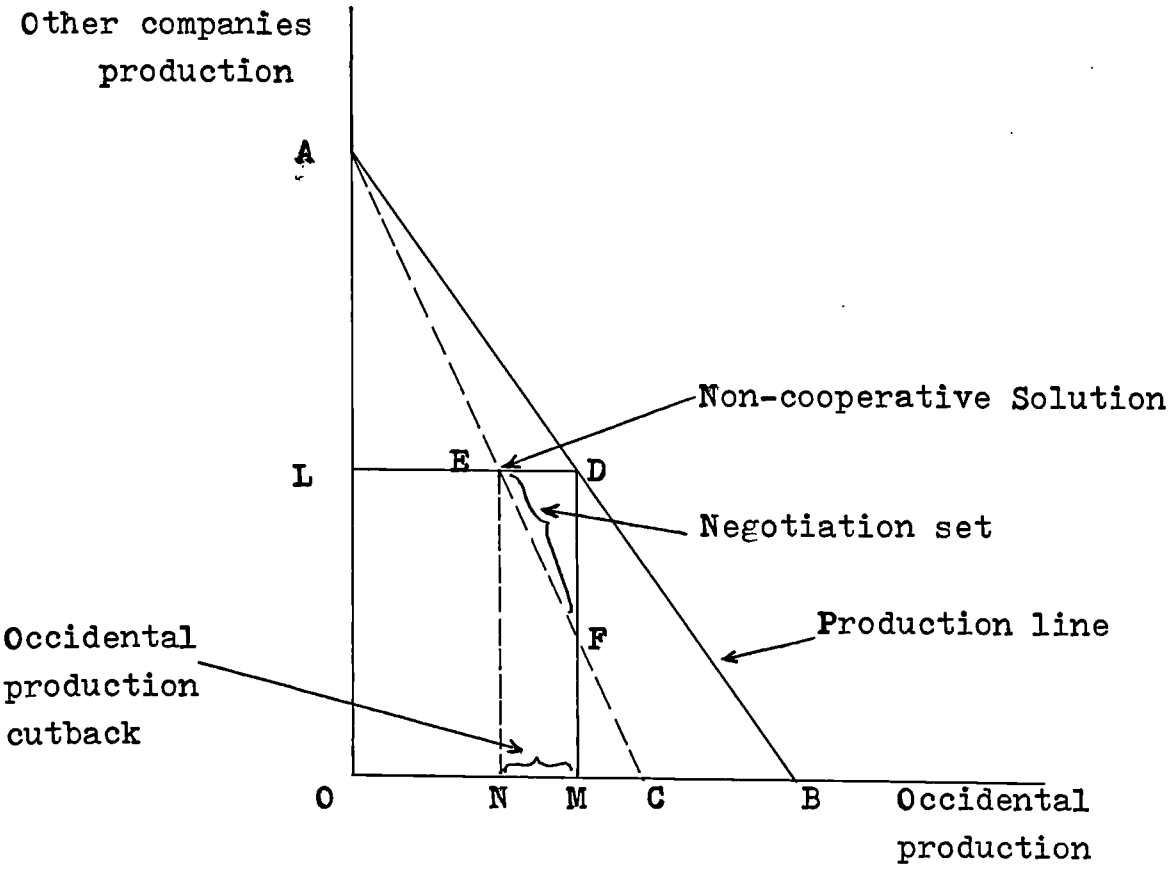


Figure 7.1 Oil companies game (stage one)

shift in the production line from AB to AC where Occidental's production is reduced by NM, while the other companies' production was unchanged at OL. If this was the case, point E would determine the outcome of the game. However, the new position created a negotiation set, EF, between Occidental as a first player and the other oil companies as the second player. That is, if the companies wanted to deter Libyan action and back Occidental in not accepting Libyan demands. Esso, when appealed to by Occidental, faced a dilemma; either to cooperate with Occidental in order to deter the Libyan action, or to let its competitor, Occidental, face the Libyan action alone. Esso decided to take the latter option knowing that it might be the next to be ordered by the Libyan Government to cut its production. Such a response by Esso on the grounds of the past relations with the independent companies eliminated any means of deterrence to Libyan threats. This incident, in particular, directed the outcome of the game towards non-cooperation, point E in the Figure above.

The Government then knew that the companies would not resist its actions. Accordingly, it imposed more cutbacks on Occidental and other companies as well (Oasis, Mobil, Esso,...). This shifted the production line to the left even further, to RS, showing that the problem is no longer Occidental's, but that of Oasis, Mobil and others, as shown in Figure 7.2 below.

The Figure shows that the negotiation set was widened and this made reaching an agreement even harder for the producing companies whose production had not yet been reduced. The producing companies would end up at a point like Y, somewhere between K and H. This point is clear enough to indicate the worsening position, in terms of production only, that the companies ended up with. Occidental's production would be reduced by NG, while other companies' production would be reduced by LJ.

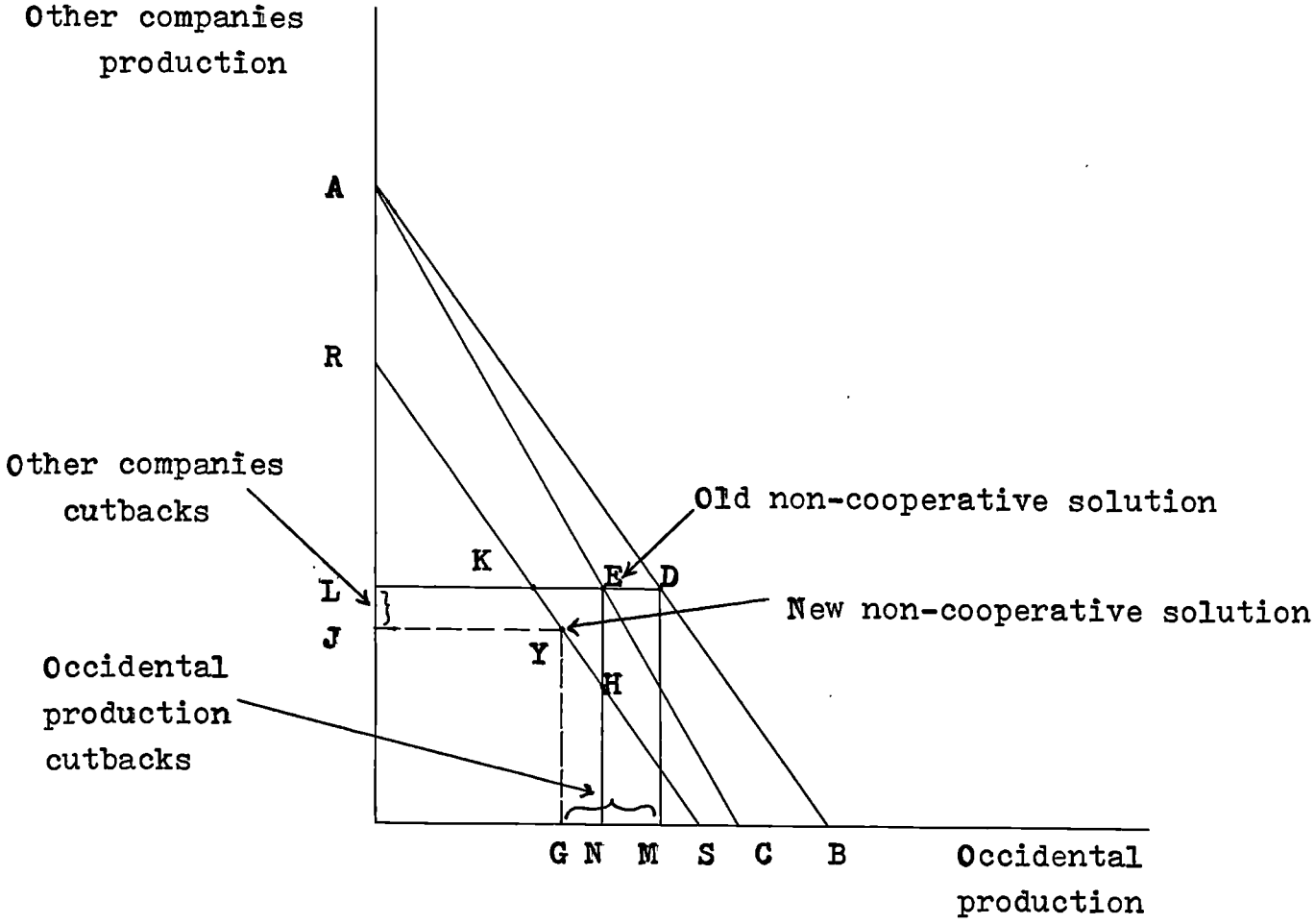


Figure 7.2 Oil companies game (stage two).

Considering the profitability of the companies the position would be different, because when the companies agreed to accept the Government terms the price was increased by $0.30, which of course increased the companies' profits after the storm was over. This matter was raised in Chapter 3; I showed that the incremental increase in posted prices was divided between the Libyan Government and oil companies. I also showed that there was no loss to the oil companies, but the advantage of cheap Libyan oil in comparison to other oils in the Middle East was almost removed.

The above is a theoretical assessment, but, practically, in December 1969 (less than four months after the Libyan Revolution) a committee was established with membership drawn from officials of the Ministry of Petroleum, to negotiate with oil companies to adjust the posted price of Libyan crude oil [Al-Thaurah 23 Dec.1969]. The first meeting on January 1970 was followed by a further meeting of heads of oil companies on 29 January, which was addressed by Colonel M'uammar al Qadhafi, who had emerged as leader of the Revolutionary Command Council. In his address to the companies he made the remark which was to become famous, that "*the Libyan people, who have lived for five thousand years without petroleum, are able to live again without it*". This statement, together with other reasons mentioned above, made Libya's threat to oil companies credible. Both Occidental and Esso had agreed in principle on a price adjustment, and had made some proposals for small increases to be phased in over a period of years. These had been dismissed by the Pricing Committee as trivial.

It was widely expected that the Government would first turn its attention to Occidental, since this company had no oil resources other than its Libyan fields and was thus most susceptible to pressure. Occidental was ordered to cut back its production in successive stages by nearly 400,000 b/d. In July 1970 Oasis was subject to similar treatment, having its

production allowance reduced by 125,000 b/d (after having reached over one million b/d earlier in the year), and in August Mobil's output was reduced by 55,000 b/d. Further cutbacks were imposed on Occidental and Esso (110,000 b/d) at the beginning of September.

During this period some other important decisions were taken by the Government. First, a decree of July 4 nationalised the marketing of oil products in Libya and took over all distribution installations and service stations. This affected the three companies Esso, Shell and Asseil, which distributed and marketed oil products in Libya. Second, Esso was prevented from exporting Liquid Natural Gas (LNG) from Mersa al Brega, pending an adjustment of prices, and also from drilling twelve fill-in wells on the Zelten Field. Third, new port dues of 1 cent/b were imposed on tankers shipping oil. Fourth, in a decree issued at the end of August, overseas payments by oil companies to employees and contractors were banned.

The decision by Occidental to concede higher posted prices marks, in a sense, the end of an era in the international oil industry, and the beginning of a new one. The basic agreement with Occidental was for an increase in posted prices of 30 cents/b, to be raised by a further 2 cents/b on 1 January of each of the following five years [Ghanem 1975 p.302]. The generalized agreement was later accepted by the other oil producing companies. The most important measure included in this agreement was a rise in the rate of tax, from 50% to 58%. This was rationalized as the consolidation of 5% of pre-tax profits which Occidental was contributing towards the development of Kufra (an agriculture development in the Oasis of Kufra, agreed when the concessions were awarded in 1966). A further 3% was in lieu of back payments of tax on the higher posted price, which was to apply retroactively to the beginning of Occidental's production in 1968. The 5% increase of tax in lieu of the Kufra

expenditure doubled these payments, as Occidental had been treating them as tax deductable and recovering half as a tax credit. As for the other 3%, an option was given of making the retroactive tax payments in cash, or increasing permanently the rate of tax. Another element in the agreement which had big consequences was a change in the base gravity and in price differentials for different gravities. Even though this matter was parallel to oil prices achievements, it has received more attention since then, as will be observed through the rest of this chapter.

Hitherto the base gravity, which Esso had used for posting at $2.21/b, was 39°, with a 2 cents fall in price for each degree below this, and a 2 cents increase for 40° oil only (and no increase above 40°). The new agreement made 40° the base gravity for price, extended the 2 cents differential to each degree of gravity above 40°, and reduced the differential to 1.5 cents for each degree of gravity below 40°.

When Occidental had made the agreement, most of its cut-backs in production were restored, perhaps to encourage the other companies to make agreements; these followed within 6 weeks. First the Oasis companies, Continental, Marathon, Amerada-Hess (Amerada had merged with Hess, a major distributor and refiner on the US Eastern Seaboard, in 1969) and Shell were made an offer similar to Occidental's in the third week of September 1970. Continental, Marathon and Amerada-Hess, for each of whom their Libyan production was more than 50% of their total world-wide production, consented after a week. Shell demurred and immediately experienced an embargo on its exports. Shell's Libyan production was only 3% of its total. However, Shell subsequently agreed terms in the middle of October, and had its production restored, but was still subject to the cut-backs applicable to all Oasis production. The Government then called on all Independents, Gelsenberg, Hunt, Liamco and Grace, to capitulate. The four

companies did so at the beginning of October, together with the Amoseas companies (Socal and Texaco). This latter event broke the resistance of the majors, and after a further week Esso, Mobil, BP and Aquitaine accepted. Figure 7.3 shows the effects of these cutbacks on Libyan crude production at the time of the Libyan conflict with the oil companies in the early 1970s. This downward trend of crude production, together with the increase in oil revenues shown in Figure 6.1 (Chapter 6), form a unique outcome of the game Libya played with the foreign oil companies.

As a result of all the Government-company agreements the new base posted price for Libyan oil became $2.53/b for 40° API from 1 September 1970, applied retroactively to 1 January 1965. This was to rise by a further 2 cents/b on 1 January each year for the next five years. The new gravity differentials of 2 cents per degree above 40° and of 1.5 cents per degree below 40° raised the price of all oils other than 40° by more than the basic 30 cents/b. The tax rate of profits was raised from 50% to an average 54%.

The distinctive feature of the Libyan threat, as described above, is that Libya had the incentive to carry out the threat if the companies did not comply with its demands, because of the reasons mentioned above namely;

(a) The availability of foreign exchange reserves.

(b) The change in the Libyan regime from a conservative government to an anti-Western government.

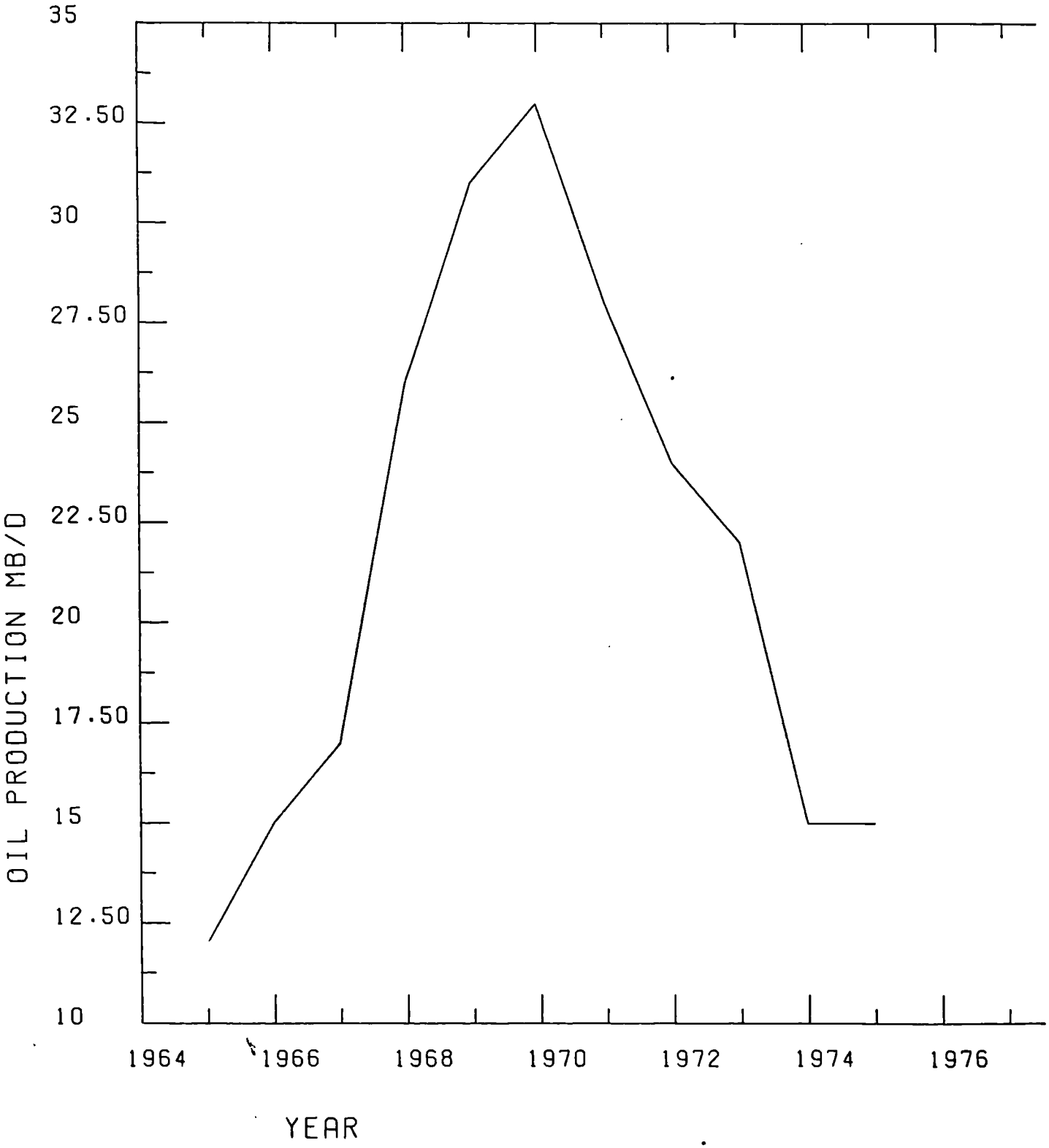
(c) The attitude of the new regime towards foreign oil companies.

(d) The non-cooperation between oil companies working in Libya.

As I argued in Chapter 3, the threat and not its fulfilment gains the end. Libyan threats to oil companies showed that fulfilment is not required if the threat succeeds. The credibility of the Libyan threats indicates clearly that the more certain is the contingent fulfilment, the

FIGURE 7.3

Libyan crude oil production (mb/d) 1965-75



XAXIS:SCALE AS PRINTED.

YAXIS:SCALE = Y * (10 **1)

less likely is actual fulfilment.

The Libyan threat achievement, in fact, rewarded both parties (the Libyan Government and oil companies); it simply shifted the solution point or Nash solution to the right (see Figure 7.4).

The incremental increase in posted price was divided between the government and oil companies. The Libyan gain as a result of the threat is measured by L_1L_2 in Figure 7.4, while the companies' gain is measured by C_1C_2. There was no loss to oil companies other than a temporary shortage of crude oil to their refineries due to the cutbacks, but the advantage of cheap Libyan oil in comparison to other oils was almost removed. Probably more important is that Libyan success in threatening the oil companies opened the door to other producers for similar claims, as will be discussed below.

Of course, the threat's efficacy depends on the credulity of the other party, and the threat is ineffectual unless the threatener can rearrange or display his own incentives so as to demonstrate that he would, *ex post*, have an incentive to carry it out. An example of this case (fulfilment) is provided from the treatment of the Shell oil company in August 1973, when its production was embargoed. The event had no negative effect on the Libyan Government, while Shell actually lost Libyan low-sulphur crude. In addition, such an embargo made it clear to all other companies that the Libyan government certainly meant what it said, and thus made credible the threat to the oil companies.

OPEC's view of Libyan tactics: OPEC had supported the implementation of conservation in Libya, and viewed with satisfaction the cut-backs, which stimulated sharp increases in petroleum prices. When the Libyan settlement was achieved, the breached line of the oil companies' defence became vulnerable everywhere and the OPEC countries were not slow to attack. In

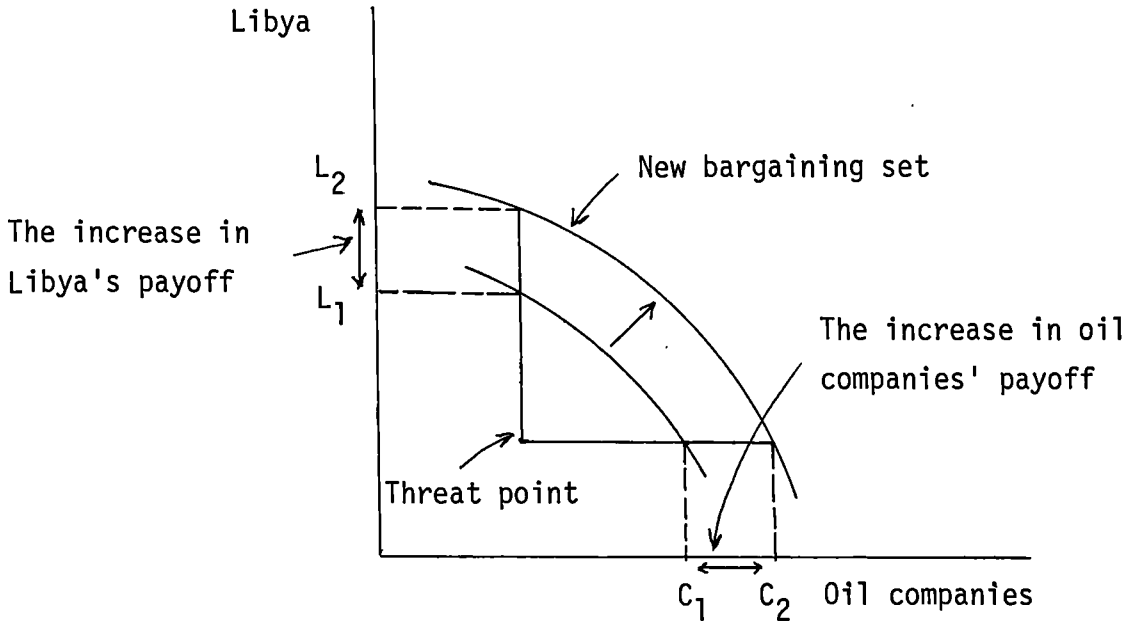


Figure 7.4 Libya and oil companies

their meeting at Caracas on 9-12 December 1970, they passed Resolution No. XXI.120, that the reference price for the purpose of determining the tax liability of the concessionaire companies should be determined by the Governments of member countries. The objectives that all member countries should adopt were:

First, to establish 55% as the minimum rate of taxation on the net income of the oil companies, as discussed in Chapter 4.

Second, to eliminate existing disparities in posted or tax reference prices of the crude oil in member countries, on the basis of the highest posted price applicable in the member countries. This should take into consideration differences in gravity and geographic location and any appropriation escalation in future years.

Third, to establish a uniform general increase in the posted or tax reference prices in all member countries, to reflect the general improvement in the conditions of the international petroleum market.

Fourth, to adopt a new system for the adjustment of gravity differentials of posted or tax reference prices, on the basis of 1.5 cents/b for each one degree of gravity for crude oil of 40^{o} and below, and 2 cents/b for crude oil of one degree above 40^{o}.

Fifth, to eliminate completely the allowance granted to oil companies as from 1 January 1971.

These demands and the companies response will be summarized below.

The oil companies, under the leadership of the majors and with the support of their governments, responded promptly to these events. In January 1971 they delivered to the Governments of the ten OPEC member countries a message proposing an all-embracing negotiation between themselves and OPEC for the achievement of an overall and durable settlement. At the same time they made an agreement between themselves,

known as the Libyan Producers' Agreement, on 15 January 1971 [PIW, 6 May 1974]. The message to OPEC countries stated that the companies could not negotiate further the development of claims by member countries of OPEC on any other basis than one which reached a settlement simultaneously with all producing governments concerned. It then proposed the broad lines of a settlement, as follows:

1- A revision to the posted prices of all crudes in all member countries of OPEC, with the provision that the new levels should be subject to a moderate annual adjustment against the yardstick of world-wide inflation, or a similar criterion.

2- A further temporary transportation adjustment for Libyan crudes, with appropriate adjustments for other short-haul crudes, such adjustments to vary both up and down by reference to a freight escalator.

3- No further increase in the tax rate percentage beyond current rates (55%), no retroactive payments and no obligatory re-investment.

4- The foregoing all to be firm for a period of five years from the date of settlement, after which the terms would be subject to review.

The companies reaction and OPEC demands can be summarized as follows:

Summary of OPEC Demands and Oil Companies Response

OPEC demands	Oil companies response
1.A rise in the taxation rate from 50% of net income to 55%	1.Negotiations with OPEC as a whole
2.To eliminate posted prices disparities	2.A revision to posted oil prices
3.An increase in posted prices	3.Further adjustments to *short-haul crudes*
4.The adoption of a new system for gravity differentials adjustments	4.Agreed to increase tax rate to 55% but not more
5.Eliminate completely company allowances from 1 Jan.1971	5.The terms would be subject to review after 5 years from the agreement

The message also expressed great concern over OPEC's continuing series of claims and proposed an all-embracing negotiation between the companies and OPEC. The companies asked for OPEC's reaction as soon as possible, and offered to meet OPEC representatives "whenever and wherever" the producing governments wished. Each side had its position clear; the way for negotiation was open.

The Tehran Conference, as I mentioned in Chapter 4, convened as scheduled on 12 January 1971 in a very tense atmosphere. The first meeting broke up without any fruitful results. The OPEC oil ministers were frustrated by the companies' position but resolved to stand firm. The Saudi Oil Minister Yamani warned after the 12 January breakdown:"*I am afraid that they are going to have to pay a heavy price for this, for it will hurt them as well as the innocent consumer*" [MEES .15 Jan.1971]. The companies' representatives, on the other hand, were alarmed at the deteriorating situation. It became clear that they were stalling for time while a

strategy was worked out in New York for dealing with the Tehran negotiations and the Libyan demands. John McCloy, the companies' legal adviser, suggested that, in addition to the companies' general strategy, "*it would be wise if the government could enter into this thing and get the heads of the countries involved to moderate their demands*" [Sampson 1975 p.218]. To accomplish this task, the State department sent Under-Secretary John Irwin to Iran. When Irwin arrived to meet the Shah in Tehran, the companies' collective message, with diplomatic support, was received by OPEC and took all OPEC countries by surprise. Denouncing what he called a "poisoned letter", the Libyan Deputy Minister proclaimed that "*Libya will defeat the consuming countries and also the oil companies*". On 19 January he put pressure on Hunt and Occidental to dissociate themselves from the industry-wide approach "*or face government action*".

In Tehran, meanwhile, the Shah and his Oil Minister, Amuzegar, objected to OPEC-wide negotiations. By then the companies recognized OPEC's demands for two separate negotiations, but they nevertheless tried to maintain a bridge between the separate Gulf and Mediterranean discussions. On 25 January the companies split their negotiating team, with BP's Chairman Lord Strathalmond heading the Tehran group, and Exxon's Piercy leading the Mediterranean team.

On 28 January Strathalmond began the Tehran "Gulf only" negotiations. The Libyans refused to negotiate in Tripoli until the Tehran negotiations were concluded. The Gulf countries set a five-day deadline by which negotiations were to be finalized. The companies proposed an increase in the posted price of 15 cents per barrel and allowances for inflation. The Gulf countries demanded an extra 54 cents a barrel and a much higher inflation allowance. The producing countries threatened to legislate for their terms unilaterally if the companies did not voluntarily accept OPEC's

demands. If the companies did not accept legislation, OPEC threatened to "take appropriate steps including total embargo". Only Indonesia abstained from the total embargo vote.

A full OPEC meeting was called on 3 February, and passed Resolution XXII.131, which set 15 February as the deadline for agreement with the companies. Discussions were thereafter resumed and agreement was reached on 15 February, which became known as the Tehran Agreement. It incorporated the substance of OPEC demands, as listed in Caracas the previous December, as well as most of the safeguards for stability requested by the oil companies in their message of 16 January 1971. The tax rate was stabilised at 55%, and posted prices were raised by 35 cents/b. These posted prices were to be increased by 2.5% plus 5 cents/b on the following first of June, and a further 2.5% plus 5 cents/b on 1 January in each of the years 1973-75. The price differentials for different gravities were to be those proposed in the OPEC Caracas Resolution, and there were to be further adjustments for claims from individual states in respect of existing posted price disparities. The allowances dating from the OPEC formula of 1964 were to be eliminated immediately. Table 7.9 shows the change in posting prices in all OPEC members during Feb.1970 and Feb. 1971.

Table 7.9

Posted Prices Changes In OPEC Countries($/b): Feb.1970-Feb.1971

Country	API Gravity	1970			1971	
		Feb.	Sep.	Nov.	Jan.	Feb.
Algeria	Saharan Blend	2.650	-	-	2.700	2.700
Gabon	Mandji	1.539	-	-	-	1.700
Indonesia	Minas	1.700	-	-	-	1.700
Iran	Iranian Light 34	1.790	-	-	-	2.170
Iraq	Basarah	1.720	-	-	-	2.155
Kuwait	Export 31	1.590	-	1.680	-	2.085
Libya	Libyan Light 40	2.230	2.530	-	-	2.530
Nigeria	Nigerian Light	2.170	2.420	-	-	2.420
Qatar	Dukhan 40	1.930	-	-	-	2.280
S.Arabia	Arabian Light 34	1.800	-	-	-	2.255
The U.A.E.	Murban 39	1.880	-	-	-	2.235
Venezuela	Boscan	1.429	-	-	1.434	1.434

Source: *Annual Statistical Bulletin of OPEC*, [1982], 155-175.

The Libyans were dissatisfied with the Tehran Agreement, both on the grounds of inadequate price increases and because of the value of the short-haul freight premium for Libya quantified and agreed there. On the first count it was pointed out that Libya was taking from the companies royalty oil in kind and selling it at substantially more than posted prices, thus demonstrating that posted prices were too low [PIW, 18 Jan.1971]. On the second, it was widely felt that agreement on a Libyan short-haul premium was an unwarranted intervention in Libyan affairs, to achieve an all-embracing solution which the companies wanted but Libya had rejected. A settlement was reached (the Tripoli Agreement of 20 March 1971) [Tugendhat 1975], and took the form of each company submitting an

offer of amendment to its Deeds of Concession which comprised one integrated proposal. The new posting of $3.32 for 40° gravity oil was broken down into a Base Posting of $3.07, a Suez Canal allowance of 12 cents/b and a temporary Freight Premium of 13 cents/b. The Base Posting was to be increased by 0.2 cents/b for each 0.1° degree of gravity above 40°, and decreased by 0.15 cents/b for each 0.1° degree of gravity below 40°. Libya thus adopted the gravity differential prices embodied in the OPEC Caracas Resolution and the Tehran Agreement, changing for each one-tenth of a degree, instead of for each one full degree as fixed in the September 1970 Agreement.

The base posting included, for the first time, a low-sulphur premium of 10 cents/b, applicable as long as sulphur was less than 0.5% by weight of Libyan crude. This sulphur premium was to be increased by 2 cents/b on 1 January of each of the years 1972-75. The Base Posting was to be increased by 5 cents/b plus 2.5% as from the Operative Date, and was to be further increased by the same amounts on 1 January of each years 1973-75 [Waddams 1980 p.243]. The only difference between this and the Tehran Agreement was the advancing of the first increases from 1 June to 20 March 1971, the Operative Date. The Suez Canal Allowance would be reduced to 4 cents/b on the first day the Canal was re-opened to ships of 37 feet draft, and eliminated entirely if and when it was open to commercial ships of 38 feet draft. The Temporary Freight Premium would be varied quarterly by 0.058 cents/b for each 0.1%. A permanent short-haul freight premium was incorporated in the Base Posting. This temporary premium was intended to reflect the excess of current high freight rates over the norm. Thus there was introduced a proposal made by the Ministry of Petroleum Affairs in 1967 for the proper implementation of the Petroleum Law provisions, that posted prices should include necessary adjustments for freight. This proposal had

been ignored by the companies at the time.

Thereafter the differences between Libyan and the Arabian Gulf prices varied, as the temporary freight premium changed and the low-sulphur premium for Libyan oil rose by 2 cents/b a year. The contrast between the price differentials after the Tripoli Agreement and those prevailing before the revolution suggest that the Libyan advantages over Arabian Gulf oils in gravity, quality and geographical position had by then been more than adequately recognised in prices. This is shown in Table 7.10 where the posted price of Arabian Light in relation to the Libyan light (Brega 40_{o}), had increased from 63.24% in March 1971 to 66.75% in July and 67.23% in October of the same year. Libya had by now lost the cost advantage which it had had in the markets of Europe and North America [PIW 19 April and 10 May 1971].

Table 7.10

Marker and Libyan Light Prices($/b):March-Oct.1971

Period	Libyan Light (40^{o})	Arabian Light (34^{o})	(%)*
March	3.447	2.180	63.24
July	3.423	2.285	66.75
October	3.399	2.285	67.23

(*) Percentage of Arabian Light prices in relation to Libyan Light prices.

Source: *Annual Statistical Bulletin of OPEC*, 1982, for Libyan crude oil prices p.164, and for Arabian Light prices p.167.

On 15 August 1971, the United States of America suspended convertibility of the US dollar into gold, and thereafter the value of the dollar depreciated in terms of most of the major currencies of the countries in which Libyan oil was sold. In September 1971 the Libyan currency was changed from the pound to the Dinar at par, and at the same time the Libyan

Dinar was revalued in terms of the US dollar from the middle rate of $2.80=LD1 to $2.90 [Central Bank of Bank of Libya March 1974 p.7]. This was done just before the oil companies were due to make large payments to the Libyan Government (in Libyan currency, unlike the Middle Eastern concessions, in which such payments were made in dollars) and caused confusion about how much payment was due.

The Libyan Government ensured that the companies should buy at this rate to pay their Dinar dues which had already been calculated in accounts at the $2.80 rate, thus costing them 3.5% more in dollars, which would accrue to the Bank of Libya.

Libya, the new-comer to the oil industry, was able in few months in 1970-71 to achieve what the whole of OPEC had been trying to accomplish for a decade. The Libyan build up of huge foreign exchange reserves as a result of fast development of the oil sector, and the inability of the non-oil sector to absorb the accumulated revenues from oil activities, had put Libya in a well-funded position and helped to exert more pressure on the oil companies.

It might be argued that if there had been no revolution in Libya in 1969, there would have been little success for Libya and OPEC. It could equally be argued that if the revolution happened not to have found such huge foreign reserves when it came to power, there would have been no such progress for Libya and consequently for OPEC as a whole. But the fact is that the combination of the availability of hard currency to Libya together with the rise of the anti-Western 1 Sept. revolution made Libyan and OPEC success just a matter of time.

Thus Libyan success was only a prelude to the world-wide wave of bargaining which began when other OPEC members started to follow Libya's lead. As Marwan Iskander [1973 p.78] put it:"*There is little room for*

doubt that Libya's success started the snowball rolling and led to Resolution XXI.120 and consequently the Tehran and Tripoli agreements".

7.4 Libya and OPEC triumph:

Even though Libya had successfully made the first steps in breaking the solidarity of the oil companies by raising its posted prices, it should be clear that the politics of the Middle East had been the direct cause for the quadrupling of oil prices. As a result of the cut-backs in production and embargoes to the USA and the Netherlands imposed by the Arab States on 27 October 1973, less than 20 days after the outbreak of hostilities between Israel and Egypt oil was sold at auctions by the Iranians at $17/b, and by Nigeria and Libya at over $20/b, mostly to American independents. On 23 December the OPEC Gulf States announced their decision to increase posted prices in such a way as to yield a government take of $7/b. This resulted in a posting for the Arabian Light 34°, which was the marker crude, of $11.651/b, as from 1 Jan. 1974. Libyan posted prices were changed to accord with the change in the marker crude price, with adjustments for freight and low-sulphur premium. Libyan crude of 40° rose from $4.60/b at the beginning of October 1973 to $8.925 on 19 October and to $15.768 on 1 January 1974. The relationship with the marker crude prices of the last two postings were as shown in Table 7.11 below.

Table 7.11

The Relationship Between Marker Crude And Libyan Light In($): 1973-74

Item	19 Oct. 1973	1 Jan. 1974
Posted Price, Arabian Light 34°	5.119	11.651
Gravity Differential	0.120	0.360
Permanent Freight Differential	1.740	1.811
Low-Sulphur Premium	1.336	1.336
Suez Canal Premium	0.152	0.152
Temporary Freight Premium	0.458	0.458
Posted Price, Libyan Light 40°	8.925	15.768

Source: *Ghanem*, [1975], p.222.

The gravity differential applied for 1974 was 6 cents per degree below as well as above 40°, although the Gulf States decided only to double existing gravity differentials from 1.5 to 3 cents per degree below 40°, and from 3 to 6 cents per degree above 40° [Ghanem 1975].

As conditions became more stable, embargoes lifted and freight prices fell, the Libyan price was soon seen to be too high. It compared with $8-$9.5/b acquisition cost of the Arabian marker crude, where buy-back prices to the companies for the participation oil had been set at 93% of the posted price of $11.651/b. Beginning in April 1974, the buy-back price for oil was lowered in Libya by stages to reach $11.86/b at the beginning of 1975 as shown in Table 7.12 below.

Table 7.12

Comparison Between Marker Posted Price,Brega's Price

And Libyan Royalty Sales Price In (US$):1974-75

Date	Marker Posted Price	Brega Posting	Royalty Sales Price
1 Jan.1974	11.651	15.768	16.000
1 Nov.1974	11.251	14.600	11.860
1 Oct.1975	12.376	16.060	12.320

Source: *OPEC Annual statistical Bulletin,* [1982], 164,168.

And Wright, [1981], p.236.

In early 1974 the Gulf states raised royalties to 16.67% and profit taxes to an average of 65.7%, posted prices remaining unchanged. Libya followed the increase in royalty but raised its tax to only 60%. At the same time the buy-back price for companies was reduced to $12.50/b, making an average acquisition cost to them of $11.66/b and average government take $11.16/b. On 1 January 1975, Libya increased company tax to 65%. This left the average acquisition cost to the companies unchanged at $11.66/b.

Oil companies were seen, by OPEC countries, to be making enormous profits, because the higher the posted price, the higher the oil company profit on that part of their concessions left to them. The raising of royalty and tax rates diminished the profit margins of the companies on their own oil. In February 1975 Linoco cut most of its sales prices, which was the same as the buy-back prices to the companies, by between 15 and 29 cents/b, to reduce the average acquisition cost to the companies by 10 cents to 11.56. This was further reduced in stages to $10.90 $11.00 in June. At this time Brega 40°, at $10.97/b acquisition cost, was only 73 cents/b more costly to the companies than the Arabian marker crude at $10.24 (see Table 7.12 above)..

In October 1975 Libya raised its sales prices, posted prices and hence

company acquisition costs by 10%, in line with the OPEC decision. In July 1976 OPEC attempted to adopt a new system, on the lines used by Algeria, of replacing the fixed gravity differentials and sulphur premium with prices derived from net-back calculations of the value of different oils in the markets, and Libya followed suit. As a result the price band of the various oils widened from 22 cents/b to 57 cents/b. The prices of 42° Libyan crude was raised from $12.62/b in December 1976 to $14.25 as from July 1977 [Central Bank of Libya 1972].

In the context of oil producing countries policy aimed at off-setting the erosion in the purchasing power of their resources on account of depreciation of the dollar, they made varying rises on their crude oil prices, depending on the quality of crude and proximity to markets. Accordingly, the prices of 40° Libyan crude (Brega) was raised from $13.85/b in December 1978 to $14.69/b as from January 1979, $23.45/b as from the beginning of July 1979 and then to $29.95/b in December 1979. On 1st January 1980 the price stood at $34.67/b, then was raised to $37/b from September, and $41/b in January 1981 [Central Bank of Libya 1979]. The latter increases in oil prices had been as a result of the cutback in Iran's production due to the Iranian Revolution and the fall of the Shah's monarchy. This was further accelerated by the war between two major oil producers Iraq and Iran since 1980.

Gas contracts: The increase in the oil prices in the 1970s was associated with an increase in gas prices. Esso had contracted prices for its sales of gas to Italy and Spain in 1969 of 38.5 cents per million British Thermal Units (BTU) for ENI and 42 cents per million BTU to Catalana de Gas delivered [as a rule of thumb one cubic foot of natural gas is often taken as producing 1,000 BTU]. The securing of firm long-term contracts (20 years for ENI and 15 years for Catalana de Gas) was a necessary condition

for Esso to undertake the great investment involved, in order to give some assurance of adequate profitability. The company would pay royalty of 12.5% of the value of all natural gas derived from the concession area after deducting any handling charges, duties and imposts and the cost of transport. The net income would be taxed at the rate of 50%. The tricky problem was that gas would be deemed to be a by-product of the production of oil, or of drilling for oil, and its costing could vary between nil and full allocated oil production costs on a deemed equivalence of so much gas equal to one barrel of oil.

After the 1970 oil price settlement, the government insisted on the prices to the Italian and Spanish gas customers being the same, thereby claiming to dictate prices, not only to Esso but also to the purchasers of the gas from Esso. At the time of the 1971 oil price negotiations culminating in the Tripoli Agreement, a price of 43 cents/mbtu was accepted by the Spanish customer. The royalty and tax reference price in Libya was agreed at 34 cents/mbtu, raised from the original proposal by Esso of 20.6 cents/mbtu. In accepting this, Esso reduced its freight deduction from 11 cents to 9 cents per thousand cubic feet. After the great rises in oil prices in 1973, the Libyan government made demands for increase in gas prices. Such rises would bring the price of gas some way towards that of oil, calculated on equivalent thermal properties of the two. A new f.o.b price of $1.62/mbtu was decreed in October 1974, but ENI refused to lift it at that price level. On a thermal basis this price would equate a barrel of crude oil at $9-$10/b. This price was far below the crude posted price, which was $15.768/b for 40° gravity; the State sale price was $11.860/b in November 1974. Within a month enough production was again allowed to supply the Spanish customer, who submitted to the price increase. Early in 1975 an agreement was reached with ENI for a price of $1.14/mbtu to be

phased in over three years, the first-year price being $1.04/mbtu. The Spanish customer thereupon demanded similar treatment. Whether he obtained it or not was not reported.

The problem of gas utilisation persisted, and gave rise to a number of warnings from the Ministry of Petroleum requiring oil producers to use it, give it to the State under Regulation 8 or suffer penalties for waste as was the case with ENI in 1974, when it refused to lift the gas because of the increase in price.

The Libyan settlement with the oil companies had been praised by all OPEC member countries, especially Iraq and Algeria. The OPEC members recognised the Libyan achievement as a guide line to follow; as a result they produced the Caracas, Tehran and Tripoli agreements. Even though the Middle East War of October 1973 had seen the biggest sudden rise in oil prices, OPEC in the pre-War period had increased its prices; as I showed in Table 7.9, the marker crude increased from $1.800/b in 1970 to $2.255/b in February 1971, and from $11.251/b in November 1974 to $12.376/b in October 1975 (Table 7.12). The profit taxes had been raised from 50% of net income to 65.7% in 1974, and at the same time royalty was raised from 12.5% to 16.67%. No doubt these developments had accumulated huge foreign exchange reserves for OPEC members, especially the Gulf members, which they used in their battle for participation with, and nationalisation, of the oil companies.

Thus Libyan success in dealing with international oil companies pulled OPEC members together in a confrontation with oil companies and the success that followed. This not only increased the per barrel revenue of OPEC governments to 65% of profits plus over 16% royalty, but also increased crude prices substantially. Moreover, the series of actions in the 1970s assured OPEC's self-confidence, which was translated into various participation/nationalisation agreements in almost all member countries.

What is left to OPEC is to maintain, as I showed in Chapter 3, the cohesiveness of its members in order to manage future market fluctuations. Meanwhile the individual members are urged, from the fact of oil exhaution, to maximize the benefits from every barrel of crude produced and to use oil revenues economically and efficiently.

SUMMARY AND CONCLUSIONS

The aim of this study has been to analyse OPEC stability which, if it exists, means that OPEC is able to determine the price of crude oil in the market. Accordingly its members should be able to assess the amount of oil revenues they receive, which is the main source of economic finance in most of these countries. Libya is taken as an example to investigate how much effect oil revenues have had on these economies. It is proposed here to bring together the main conclusions which have emerged.

The pre-OPEC oil market was a monopolistic market. The famous major oil companies known as "*Seven Sisters*" controlled virtually all of the international oil business. They also controlled all of the oil reserves in the under-developed, oil-exporting regions of the world. Oil prices were fixed administratively rather than determined by market conditions or by the forces of supply and demand.

The power of the Majors remained unchallenged until the mid-1950s, when the number of Independent companies began to increase. The latter companies competed with the Majors in refining crude oils but had little or no sources of crude in the third world.

However, the real challenge to the major oil companies was the rise of the Organization of Petroleum Exporting Countries (OPEC). Following its formation in 1960, OPEC only managed to prevent oil prices from falling. In the 1970s it moved to demonstrate its power in managing its crude oils. Royalty payments to OPEC governments increased, as well as taxes and prices. No doubt the biggest blow was the quadrupling of oil prices in 1973. Since then OPEC has been recognized by most Western economists as a cartel, controlling oil prices and production. Some went so far as to divide the cartel into sub-groups such as; Output Maximizers, Price

Maximizers and the Cartel Core. They also predicted, depending on the notion of cheating, that the collapse of OPEC is inevitable.

Among the OPEC behaviour models, that of Hnyilicza and Pindyck [1976], departed from the usual approach in viewing OPEC behaviour even, though it adopted the idea of cartelization. The model introduced game theory of which Nash Cooperative Solutions were used to explain the likely future OPEC behaviour. This model assumed that OPEC members are only interested in profits, but none of them is willing to sacrifice by reducing production to prevent a drop in prices and the consequent OPEC collapse.

In my analysis to OPEC behaviour I used game theory concepts concerning cooperative and non-cooperative behaviour to provide a comprehensive explanation to OPEC stability. An OPEC country's interests in my view may be coincidental with or opposed to the interests of its fellow members. Furthermore, the violation of price-output agreements by any member may well be met by accommodation from the other members in the form of reduced production. This sort of game suggests a possibility of sacrifice by a number of producers to prevent mutual disaster (the collapse of OPEC). This, certainly, is not acceptable by a monopolist whose main function is pure profits.

OPEC in recent years has not acted as unified cartel; while some members violated the price-output agreements, others have accommodated these violations in order to prevent unstable situations. For example, when the demand for OPEC oil fell from about 23 mb/d in 1981 to 19 mb/d in 1982 some OPEC members such as Saudi Arabia, Kuwait, and the UAE reduced their production to prevent the fall in price. Another example, in October 1984, when the North Sea oil price was reduced and Nigeria followed, immediately Saudi Arabia announced that it would cut its production in an attempt to limit further price reductions. Thus, while Nigeria violated the

price-output agreement, Saudi Arabia tried to protect the collective agreement by reducing its own production. OPEC will be stable as long as the group preference is maintained by the individual members, or at least by a sufficient number of producers.

However, OPEC stability might be equally threatened by non-OPEC producers, which significantly increased their share of crude production in the last decade at the expense of OPEC production. The only solution which increases the payoffs of OPEC and Non-OPEC producers is through cooperation and coordination strategies between world oil producers.

I also attempted to explain OPEC success in the 1970s through a formulated game between Libya and the oil companies. Libya emerged as an oil producer in the early 1960s. Helped by the quality advantage of its crude oil and the proximity to European markets, Libya managed to become a major crude oil producer in less that a decade.

In its confrontation with the oil companies, Libya first split them into two groups, Majors and Independents. The Independents were not in a position to dispute the Libyan Government demands. Libya for most of these companies was the only source of crude oil. Under the threat of a shutdown the Libyan Government enforced the cutbacks on Occidental's production. The company lacked the support of other companies, especially the majors, and had no choice but to agree to the Libyan Government's demands. Soon the other companies followed suit and signed similar agreements with the Libyan Government. OPEC immediately took over from Libya, enlarging the scale of confrontation with the oil companies and consequently strengthen the grip of OPEC over the world oil markets. Thus although the oil business started as a monopoly, since the early 1970s it has become a real game.

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